STB-1001S2

IP Set-Top Box

User's Guide

Version 1.0
09/2008
Edition 1

DEFAULT LOGIN	
Password	**123456**

ZyXEL

www.zyxel.com

About This User's Guide

Intended Audience

This manual is intended for people who want to configure the STB using the menu system. You should have at least a basic knowledge of TCP/IP networking concepts and topology.

Related Documentation

- Quick Start Guide

  The Quick Start Guide is designed to help you get up and running right away. It contains information on setting up your network and configuring for Internet access.
- Supporting Disk

  Refer to the included CD for support documents.
- ZyXEL Web Site

  Please refer to www.zyxel.com for additional support documentation and product certifications.

User Guide Feedback

Help us help you. Send all User Guide-related comments, questions or suggestions for improvement to the following address, or use e-mail instead. Thank you!

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Document Conventions

Warnings and Notes

These are how warnings and notes are shown in this User's Guide.

Warnings tell you about things that could harm you or your STB.

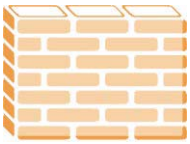
Notes tell you other important information (for example, other things you may need to configure or helpful tips) or recommendations.

Syntax Conventions

- The STB-1001S2 may be referred to as the "STB", the "device", the "system" or the "product" in this User's Guide.
- Product labels, screen names, field labels and field choices are all in **bold** font.
- A key stroke is denoted by square brackets and uppercase text, for example, [ENTER] means the "enter" or "return" key on your keyboard.
- "Enter" means for you to type one or more characters and then press the [ENTER] key. "Select" or "choose" means for you to use one of the predefined choices.
- A right angle bracket (>) within a screen name denotes a mouse click. For example, **Maintenance > Log > Log Setting** means you first click **Maintenance** in the navigation panel, then the **Log** sub menu and finally the **Log Setting** tab to get to that screen.
- Units of measurement may denote the "metric" value or the "scientific" value. For example, "k" for kilo may denote "1000" or "1024", "M" for mega may denote "1000000" or "1048576" and so on.
- "e.g.," is a shorthand for "for instance", and "i.e.," means "that is" or "in other words".

Icons Used in Figures

Figures in this User's Guide may use the following generic icons. The STB icon is not an exact representation of your STB.

STB	Computer	Notebook computer
Server	DSLAM	Firewall 
Telephone	Switch	Router

Safety Warnings

For your safety, be sure to read and follow all warning notices and instructions.

- Do NOT use this product near water, for example, in a wet basement or near a swimming pool.
- Do NOT expose your device to dampness, dust or corrosive liquids.
- Do NOT store things on the device.
- Do NOT install, use, or service this device during a thunderstorm. There is a remote risk of electric shock from lightning.
- Connect ONLY suitable accessories to the device.
- Do NOT open the device or unit. Opening or removing covers can expose you to dangerous high voltage points or other risks. ONLY qualified service personnel should service or disassemble this device. Please contact your vendor for further information.
- Make sure to connect the cables to the correct ports.
- Place connecting cables carefully so that no one will step on them or stumble over them.
- Always disconnect all cables from this device before servicing or disassembling.
- Use ONLY an appropriate power adaptor or cord for your device. Connect it to the right supply voltage (for example, 110V AC in North America or 230V AC in Europe).
- Do NOT allow anything to rest on the power adaptor or cord and do NOT place the product where anyone can walk on the power adaptor or cord.
- Do NOT use the device if the power adaptor or cord is damaged as it might cause electrocution.
- If the power adaptor or cord is damaged, remove it from the device and the power source.
- Do NOT attempt to repair the power adaptor or cord. Contact your local vendor to order a new one.
- Do not use the device outside, and make sure all the connections are indoors. There is a remote risk of electric shock from lightning.
- Do NOT obstruct the device ventilation slots, as insufficient airflow may harm your device.
- If you wall-mount your device, make sure that no electrical lines, gas or water pipes will be damaged.

This product is recyclable. Dispose of it properly.

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PART I
Using the STB

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1

Introducing the STB

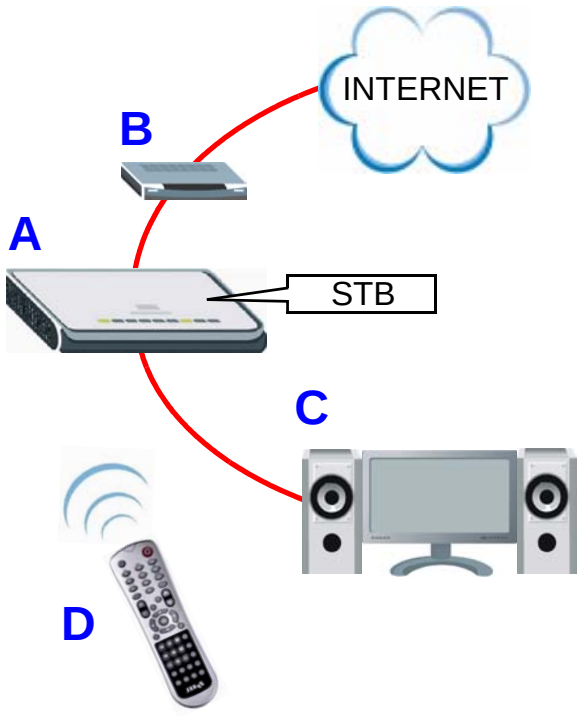
This chapter introduces the main applications and features of the STB. It also introduces the ways in which you can manage the STB.

1.1 Overview

Your STB is an IP Set-Top Box. Use it to watch Internet Television (IPTV) and Video on Demand (VOD) on your television. Connect the STB to your regular Internet access device (a broadband modem or router, for example). Operate the STB using the supplied remote control.

The following figure shows your STB (**A**) connected to your Internet access device (**B**) supplying content from the service provider on the Internet to your TV (**C**), operated by the remote control (**D**).

Figure 1 Application overview



1.2 LEDs

This section describes the LEDs (lights) on the front of the STB.

Figure 2 LEDs

Table 1 LEDs

LED	STATUS		DESCRIPTION
POWER	On	Blinking	The STB is starting up, or is in standby mode.
		Green	The STB is on and ready to use.
	Off		The STB is not receiving power, or has malfunctioned.
LAN	On	Green	The STB has an Ethernet connection to the network on the **LAN** port.
	Blinking	Green	The STB has an Ethernet connection to the network on the **LAN** port, and is transmitting or receiving data.
	Off		The STB has no network connection on the **LAN** port.
REMOTE	Blinking	Green	The Infra-red receiver on the front of the STB is receiving signals from the remote control.
	Off		The Infra-red receiver on the front of the STB is not receiving signals from the remote control.

1.3 Rear Panel Connections

This section describes the rear of the STB.

Figure 3 Rear Panel Connections

Table 2 Rear Panel Connections

LABEL	DESCRIPTION
ON/OFF	Use this switch to turn the STB on or off.
POWER	Connect this port to a suitable power supply using the provided adaptor.
USB	Use this port to connect to a USB keyboard (not supplied).
LAN	Use this Ethernet port to connect the STB to your Internet access device or network.
S/PDIF	Use this port to connect the STB to an S/PDIF (Sony / Philips Digital Interface Format) audio device.
CVBS	Use this composite video RCA connector to connect the STB to your TV's analog video input (usually colored yellow). The composite video connector does not carry audio. You must also connect your TV to one of the STB's audio connectors.
L, R	Use these to connect the STB to your audio device's analog audio inputs. **L**: The white RCA connector carries the stereo audio signal (left channel). **R**: The red RCA connector carries the stereo audio signal (right channel).

1.4 Resetting the STB

To reset the STB to its factory defaults, use the **System Setup** menu (see Section 2.2.4 on page 24).

2

The Menu System

This chapter discusses the STB's menus. These menus are displayed on the screen of the television connected to the STB, and operated using the STB's remote control.

- Use the Basic **Setup** menus to make basic changes to the STB's configuration (such as activating Daylight Saving Time or selecting the video mode).
- Use the **Advanced Setup** menus to make advanced changes to the STB's configuration (such as setting the STB's homepage or changing its IP address).

2.1 Navigating the Menus

- Each menu has two columns. On the left, you can select the setup menu you want to see, and on the right you can change the menu's settings.
- Use the ◀ and ▶ navigator keys on the remote control to move between the two columns.
- Use the ▲ and ▼ navigator keys on the remote control to highlight the menu or setting you want.
- The currently-highlighted item is colored orange.
- Use the **OK** key on the remote control to select the highlighted object.
- When you go to a new menu, the top item in the right-hand column is automatically highlighted. To move to the left-hand column, press the ◀ key.
- Highlight and select the **Save** button in each menu to store the changes you configure.

2.2 The Basic Setup Menus

Use the **Basic Setup** menus to configure how the STB shows media, to turn Daylight Saving Time on or off, or to reset the STB. Use the remote control to navigate the menu system.

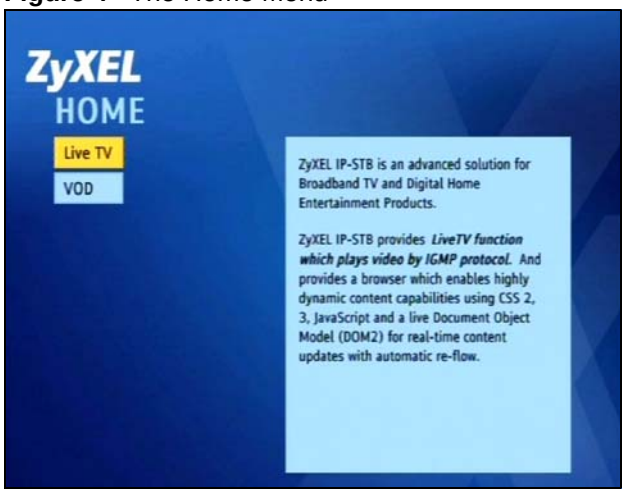
2.2.1 Accessing and Exiting the Basic Setup Menus

Take the following steps to access the **Basic Setup** menus.

1. Make sure the network is connected.

   If you are not sure whether the network is connected or not, press the **HOME** key on the remote control. If the **Home** menu displays normally, the STB is properly connected.

Figure 4 The Home Menu


ZyXEL
HOME
Live TV
VOD
ZyXEL IP-STB is an advanced solution for Broadband TV and Digital Home Entertainment Products.
ZyXEL IP-STB provides LiveTV function which plays video by IGMP protocol. And provides a browser which enables highly dynamic content capabilities using CSS 2, 3, JavaScript and a live Document Object Model (DOM2) for real-time content updates with automatic re-flow.

2 Press the **MENU** key on the remote control. The **Video Setup** menu displays (see Section 2.2.2 on page 22).

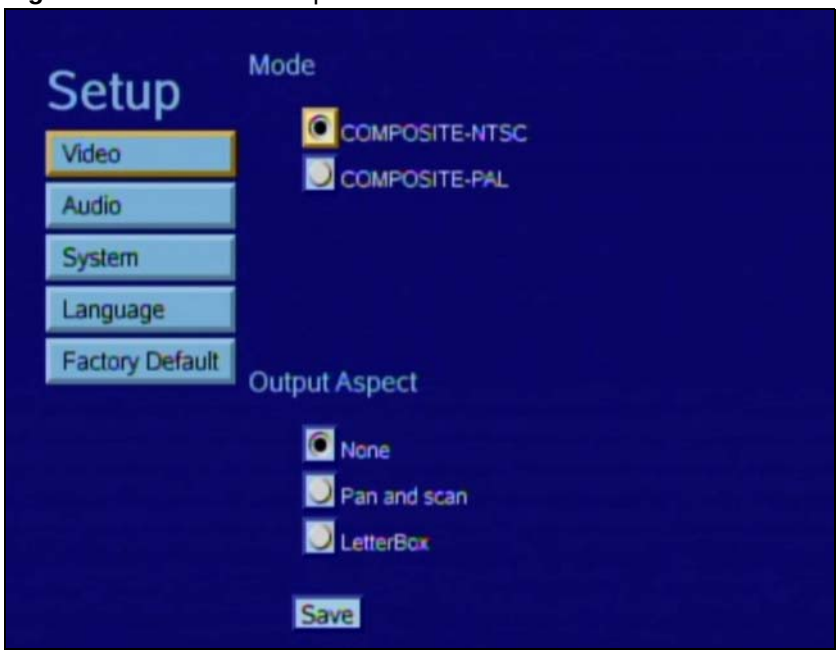
To leave the basic setup menus, press the **HOME** key on the remote control at any time. The **Home** menu displays.

Changes do not take effect until you save them. Each menu has a **Save** button.

2.2.2 Video Setup Menu

Use the **Video Setup** menu to change the STB's display type.

Figure 5 The Video Setup Menu



Do not change the **Mode** in this menu! If you do so, the picture on your TV may not display correctly. NTSC is supported in North American televisions, and PAL is supported in European televisions.

The following table describes the labels in this menu.

Table 3 The Video Setup Menu

LABEL		DESCRIPTION
Mode	COMPOSITE-NTSC	Select this if your TV supports NTSC (Common in North and Central America and Japan).
	COMPOSITE-PAL	Select this if your TV supports PAL (common in Europe and most of the world).
Output Aspect	None	Select this to display images without changing their shape.
	Pan and scan	Select this to watch TV or video with a 4:3 aspect ratio (traditional television).
	LetterBox	Select this to watch TV or video with a 16:9 aspect ratio (widescreen).
Save		Select this to store your changes. You may need to reboot your STB (use the **ON/OFF** hardware switch) before the new settings are used.

2.2.3 Audio Setup Menu

Use the **Audio** menu to change the STB's digital audio output type (analog audio output is unaffected).

Figure 6 The Audio Setup Menu

The following table describes the labels in this screen.

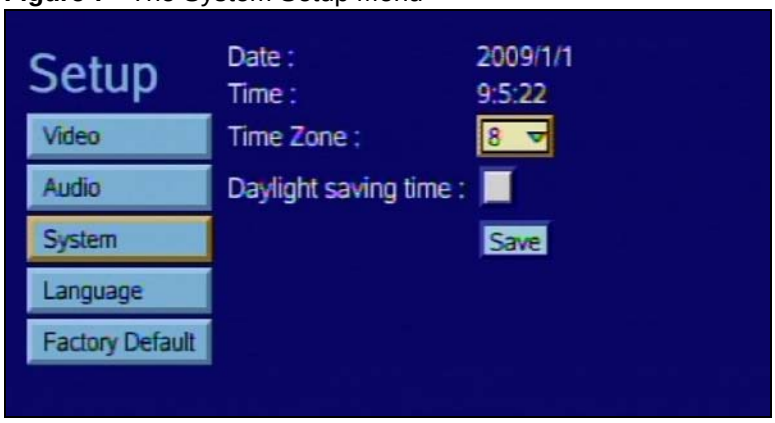
Table 4 The Audio Setup Menu

LABEL	DESCRIPTION
PCM	Select this to use PCM (Pulse Code Modulation) audio compression. Select this only if your TV or audio equipment (connected to the STB's S/PDIF connector) also supports PCM.
AC3/AAC	Select this to use AC-3 (Dolby Digital) or AAC (Advanced Audio Coding) audio compression. Select this only if your TV or audio equipment (connected to the STB's S/PDIF connector) also supports AC-3 or AAC compression.
Save	Select this to store your changes. You may need to reboot your STB (use the **ON/OFF** hardware switch) before the new settings are used.

2.2.4 System Setup Menu

Use the **System Setup** menu to check the STB's date and time settings, change the time zone, and activate or deactivate Daylight Saving Time.

Figure 7 The System Setup Menu



The following table describes the labels in this menu.

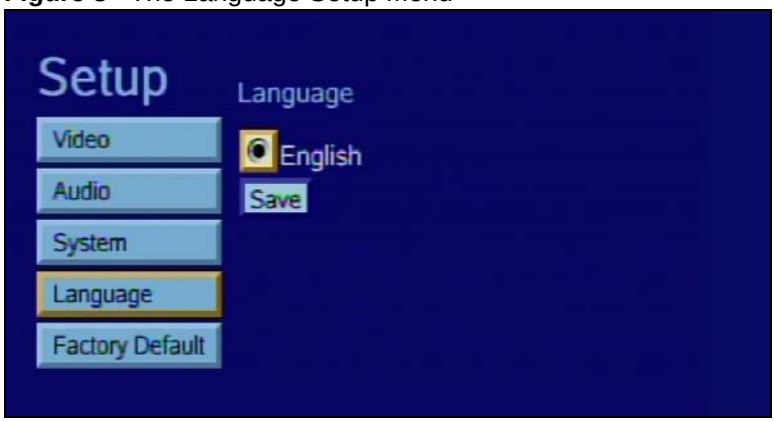
Table 5 The System Setup Menu

LABEL	DESCRIPTION
Date	This is the current date. This comes from an external time server.
Time	This is the current time. This comes from an external time server.
Time Zone	Select your time zone from the list. In the list, **0** is GMT (Greenwich Mean Time) so, for example, **8** is GMT plus eight hours.
Daylight Saving Time	Select this when Daylight Saving Time is in effect.
Save	Select this to store your configuration changes.

2.2.5 Language Setup Menu

Use this menu to select the STB's operating language. At the time of writing, only English is supported.

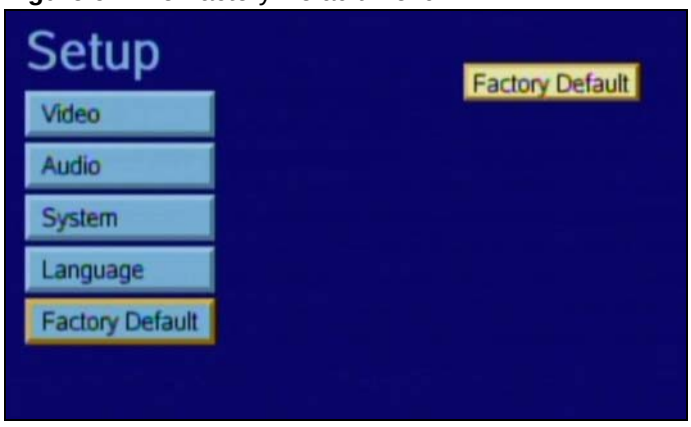
Figure 8 The Language Setup Menu



2.2.6 The Factory Default Menu

Use this screen to return the STB to its default settings.

Figure 9 The Factory Default Menu



Click **Factory Default** to return the STB to its original settings. Any configuration changes you made will be lost.

2.3 The Advanced Setup Menus

The **Advanced Setup** menus allow you to see and change network settings.

DO **NOT** use this section unless you have been specifically told to by the service provider! Misconfiguration of the menus in this section could render your STB unusable. If in doubt, contact the service provider.

2.3.1 Accessing and Exiting the Menus

Take the following steps to access the **Advanced Setup** menus.

1. Ensure that the STB is set up and working correctly, as shown in the Quick Start Guide.
2. Press **Menu** to enter the menu system.
3. Press the blue key on the remote controller three times. The **Login** menu displays.

Figure 10 The Login Menu

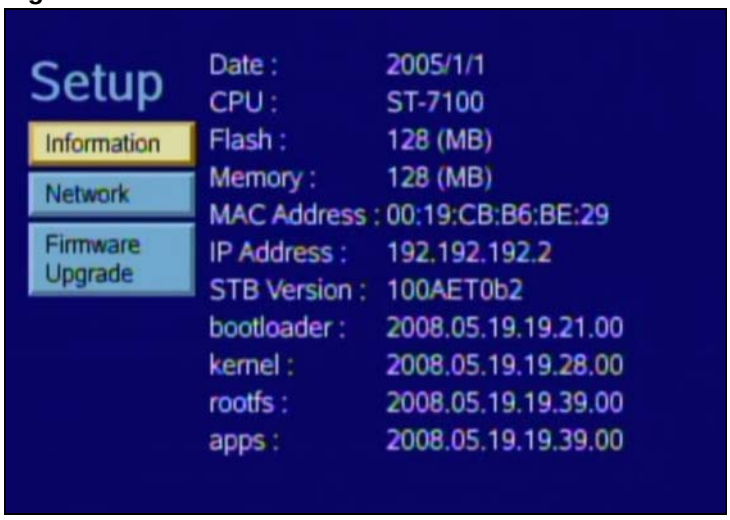
4. Enter the password. The default password is “123456”.
5. Press the ▼ navigator key to highlight the **login** button. Press the **OK** key.
   The **Advanced Setup: Information** menu displays when you are successfully logged in.

2.3.2 The Advanced Setup: Information Menu

Use this menu to see information about the STB’s current network and configuration settings.

Select **Information** from the column on the left of the screen. The following menu displays.

Figure 11 The Information Menu



The following table describes the labels in this menu.

Table 6 The Information Menu

LABEL	DESCRIPTION
Date	This shows the current date configured on the STB.
CPU	This shows the Central Processing Unit’s product code.
Flash	This shows the quantity of available flash (non-volatile) memory.
Memory	This shows the quantity of available run-time memory.

Table 6 The Information Menu

LABEL	DESCRIPTION
MAC Address	This shows the hardware Media Access Control address of the STB.
IP Address	This shows the IP address currently assigned to the STB. You can change this in the **Advanced Setup: Network** menu.
STB Version	This shows the firmware version running on the STB. Check this before you upload new firmware.
Bootloader	This shows the version number of the software that loads the STB's operating system on startup.
Kernel	This shows the version number of the code that controls the STB's basic operations.
Rootfs	This shows the version number of the STB's filesystem code.
Apps	This shows the version number of the STB's software applications.

2.3.3 The Advanced Setup: Network Menu

Use this menu to set up the STB's IP address, media server information, and homepage.

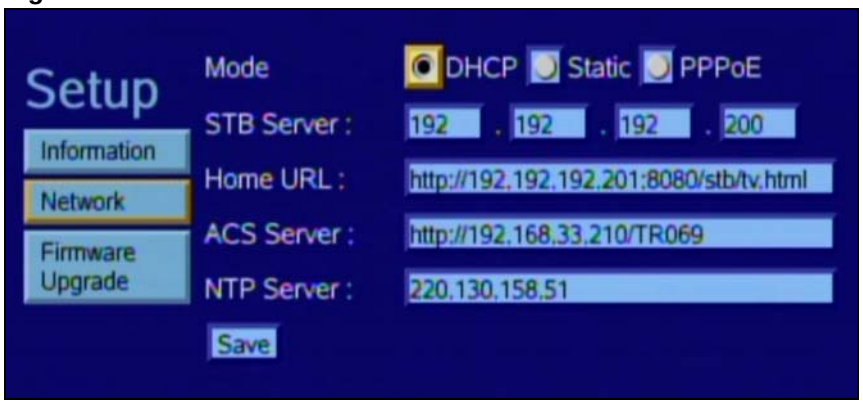
This menu differs according to the **Mode** you select.

- Select **DHCP** to have the STB obtain a dynamic IP address automatically from a DHCP server. See Section 2.3.3.1 on page 27. **DHCP** is the default setting.
- Select **Static** to assign an IP address to the STB. See Section 2.3.3.2 on page 28.
- Select **PPPoE** to use a Point-to-Point Protocol over Ethernet service. See Section 2.3.3.3 on page 29.

2.3.3.1 Network: DHCP

Select **DHCP** in the **Network** menu. The following menu displays.

Figure 12 The Network: DHCP Menu



The following table describes the labels in this menu.

Table 7 The Network: DHCP Menu

LABEL	DESCRIPTION
Mode	Select **DHCP** to have the STB obtain an IP address automatically.
STB Server	Enter the IP address of the media server which supplies TV and video to the STB.

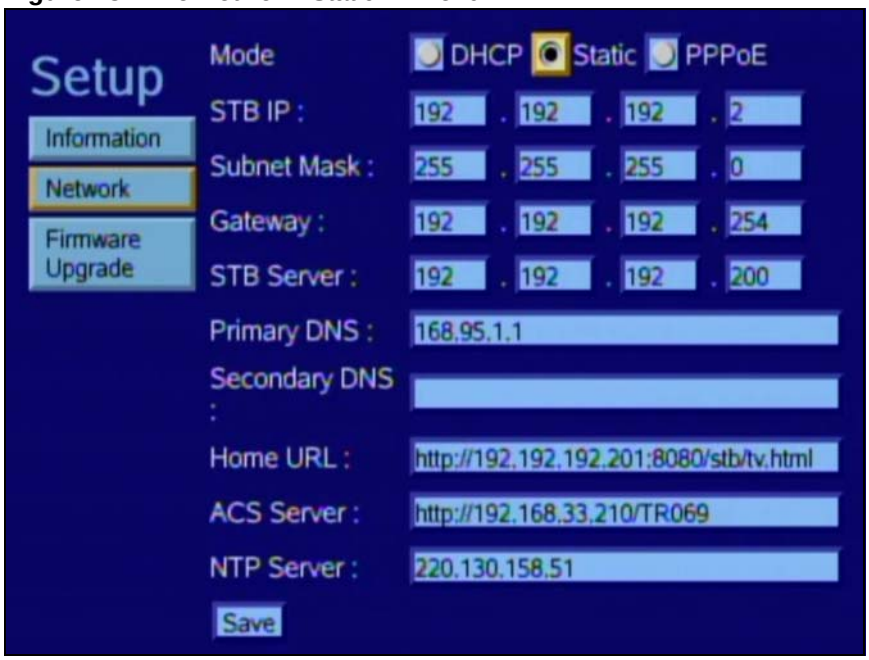
Table 7 The Network: DHCP Menu

LABEL	DESCRIPTION
Home URL	Enter the address of the homepage the STB uses as the Home menu (the screen that displays when you press the **HOME** key on the remote control).
ACS Server	This field is for remote management. Change the information in this field only if you were specifically told to do so. Enter the address of the auto-configuration server from which the STB gets its operating settings.
NTP Server	Enter the address of the Network Time Protocol server from which the STB gets its date and time settings.
Save	Select this to store your configuration changes.

2.3.3.2 Network: Static IP Address

Select **Static** in the **Network** menu. The following menu displays.

Figure 13 The Network: Static IP Menu



The following table describes the labels in this menu that were not already described in table 7.

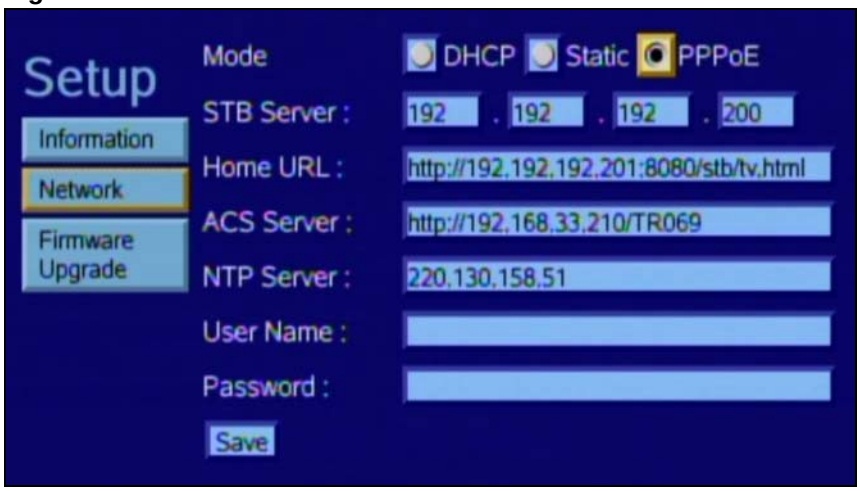
Table 8 The Network: Static IP Menu

LABEL	DESCRIPTION
Mode	Select **Static** to give the STB a specific IP address.
STB IP	Enter the IP address you want to assign to the STB.
Subnet Mask	Enter the subnet mask of the STB's IP address.
Gateway	Enter the IP address of the network gateway.
Primary DNS	Enter the IP address of the primary Domain Name Server. DNS allows your STB to resolve domain names (such as zyxel.com) into IP addresses.
Secondary DNS	Enter the IP address of the secondary (backup) Domain Name Server.

2.3.3.3 Network: PPPoE

Select **PPPoE** in the **Network** menu. The following menu displays.

Figure 14 The Network: PPPoE Menu



The following table describes the labels in this menu that were not already described in table 7.

Table 9 The Network: PPPoE Menu

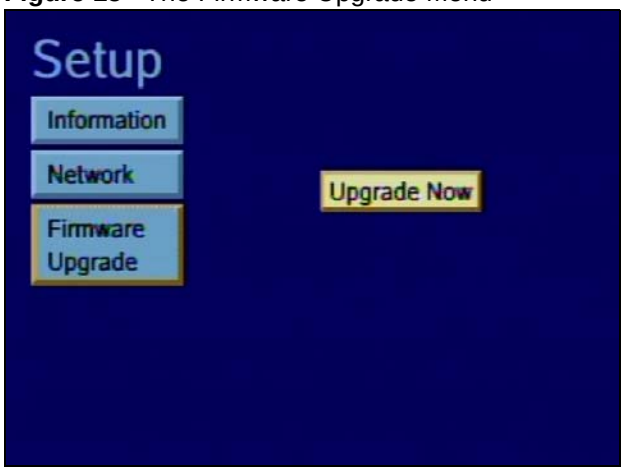
LABEL	DESCRIPTION
Mode	Select **PPPoE** to use a Point-to-Point Protocol over Ethernet service.
User Name	Enter the username for your PPPoE account.
Password	Enter the password for your PPPoE account.

2.3.4 The Advanced Setup: Firmware Upgrade Menu

Use this menu to get new firmware from the autoconfiguration server. You must be connected to the network and have a valid autoconfiguration server address configured in the **Advanced Setup: Network** menu's **ACS Server** field (see Section 2.3.3 on page 27).

Select **Firmware Upgrade** from the column on the left of the screen. The following menu displays.

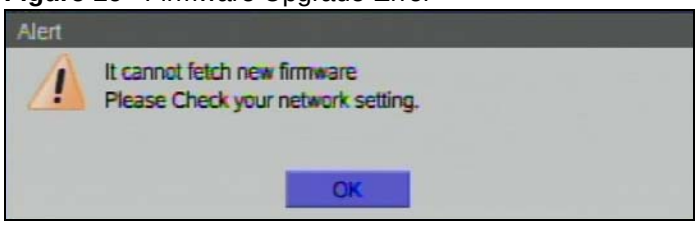
Figure 15 The Firmware Upgrade Menu



If you want to get new firmware from the auto-configuration server, click **Upgrade Now**. The STB contacts the autoconfiguration server and downloads the firmware.

If the following screen displays, the STB cannot reach the autoconfiguration server. Check the settings in the **Advanced Setup: Network** menu (see Section 2.3.3 on page 27) and try again.

Figure 16 Firmware Upgrade Error



3

Troubleshooting

This chapter offers some suggestions to solve problems you might encounter. The potential problems are divided into the following categories.

- Power, Hardware Connections, and LEDs
- STB Access and Login
- Internet Access

3.1 Power, Hardware Connections, and LEDs

The STB does not turn on. None of the LEDs turn on.

1. Make sure the STB is turned on.
2. Make sure you are using the power adaptor or cord included with the STB.
3. Make sure the power adaptor or cord is connected to the STB and plugged in to an appropriate power source. Make sure the power source is turned on.
4. Turn the STB off and on.
5. If the problem persists, contact the vendor.

The **POWER** (⏻) LED is red, or blinking green.

1. The STB may be in standby mode. Try using the remote control's ⏻ button to turn it on.
2. Wait for a short while. The STB may take a minute or so to start up.
3. If the LED still does not turn steady green, turn the STB off and on.
4. If the problem persists, contact the vendor.

One of the LEDs does not behave as expected.

1. Make sure you understand the normal behavior of the LED. See Section 1.2 on page 18.

2 Check the hardware connections. See the Quick Start Guide and Section 1.3 on page 18.
3 Inspect your cables for damage. Contact the vendor to replace any damaged cables.
4 Turn the STB off and on.
5 If the problem persists, contact the vendor.

I cannot operate the STB using the remote control.

1 See your Quick Start Guide for instructions on using the remote control.
2 If the **REMOTE** ( ) LED does not blink when you press a remote control button, the remote control's batteries may be improperly inserted or dead. Check they are properly inserted, or try replacing them.
3 Move closer to the STB and try again.
4 If the problem persists, contact your vendor.

3.2 STB Access and Login

I forgot the IP address for the STB.

The default IP address is **192.168.1.1**. Use the **System Setup** menu to check the current IP address (see Section 2.2.4 on page 24).

I forgot the password for the Advanced menus.

1 The default password is **123456**.

I cannot see or access the **Login** menu.

1 Make sure the LEDs are behaving as expected. See the Quick Start Guide and Section 1.2 on page 18.
2 If the problem continues, contact the vendor.

3.3 Internet Access

I cannot access IPTV or VOD services.

1. Check the hardware connections, and make sure the LEDs are behaving as expected. See the Quick Start Guide and Section 1.2 on page 18. Ensure that your Internet access device is working correctly.
2. Check the **Home URL** IP address in the **Network** menu.
3. Disconnect all the cables from your STB, and follow the directions in the Quick Start Guide again.
4. If the problem continues, contact your ISP or IPTV provider.

The Internet connection is slow or intermittent.

There might be a lot of traffic on the network. If you have computers or other devices using your Internet connection, try turning them off or disconnecting them. If your Internet access device uses bandwidth management, try reconfiguring it to allow the STB higher throughput.

4

Product Specifications

This chapter gives details about your STB's hardware and firmware features.

4.1 General STB Specifications

The following tables summarize the STB's hardware and firmware features.

Table 10 Hardware Specifications

SPECIFICATION	DESCRIPTION
Dimensions (W x D x H)	190 x 130.6 x 34.8 mm
Weight	0.35 Kg
Power	DC: 12 V, 1.5 A
LAN Ethernet Port	Auto-negotiating: 10 Mbps or 100 Mbps in either half-duplex or full-duplex mode. Auto-crossover: Use either crossover or straight-through Ethernet cables.
SPDIF Port	Sony / Philips Digital Interface Format (IEC 958 type II) audio connector.
USB Port	Universal Serial Bus 2.0 connector.
Composite Video Port	1 x CVBS RCA-type connector. Supported video standards: • PAL • NTSC
Analog Audio Ports	1 x stereo left channel RCA-type connector. 1 x stereo right channel RCA-type connector.
LEDs	POWER LAN REMOTE
Operating Environment	Temperature: 0º C ~ 40º C Humidity: 0% ~ 95% RH
Storage Environment	Temperature: -40º C ~ 55º C Humidity: 0% ~ 95% RH

Table 10 Hardware Specifications

SPECIFICATION	DESCRIPTION
Approvals	Safety UL60950-1 CAN/CSA-C22.2 No.60950-1-03 EN60950-1 IEC 60950-1 EMC FCC Part 15 Class B EN55022 Class B EN55024
Distance between wall-mounting holes on device's base panel	137 mm
Screw size for wall mounting	M4 Tap

Table 11 Firmware Specifications

FEATURE	DESCRIPTION
Default IP Address	Obtained via DHCP
Default Subnet Mask	Obtained via DHCP
Default Password	123456
Device Management	Use the remote control and the on-screen menu system to configure the STB.
Time and Date	Get the current time and date from an external server when you turn on your STB.
PPPoE	PPPoE mimics a dial-up Internet access connection.

The following list, which is not exhaustive, illustrates the standards supported in the STB.

Table 12 Standards Supported

STANDARD	DESCRIPTION
RFC 867	Daytime Protocol
RFC 868	Time Protocol.
RFC 1058	RIP-1 (Routing Information Protocol)
RFC 1112	IGMP v1
RFC 1157	SNMPv1: Simple Network Management Protocol version 1
RFC 1305	Network Time Protocol (NTP version 3)
RFC 1441	SNMPv2 Simple Network Management Protocol version 2
RFC 1483	Multiprotocol Encapsulation over ATM Adaptation Layer 5
RFC 1661	The Point-to-Point Protocol (PPP)
RFC 1723	RIP-2 (Routing Information Protocol)
RFC 1901	SNMPv2c Simple Network Management Protocol version 2c
RFC 2236	Internet Group Management Protocol, Version 2.
RFC 2408	Internet Security Association and Key Management Protocol (ISAKMP)
RFC 2516	A Method for Transmitting PPP Over Ethernet (PPPoE)

Table 12 Standards Supported (continued)

STANDARD	DESCRIPTION
RFC 2684	Multiprotocol Encapsulation over ATM Adaptation Layer 5.
IEEE 802.11d	Standard for Local and Metropolitan Area Networks: Media Access Control (MAC) Bridges
TR-069	TR-069 DSL Forum Standard for CPE Wan Management.
1.363.5	Compliant AAL5 SAR (Segmentation And Re-assembly)

4.2 Power Adaptor Specifications

Table 13 Power Adaptor Specifications

AC Power Adaptor Model	MU18-2120150-A1
Input Power	100~240 Volts AC / 50~60 Hz / 0.6A
Output Power	12 Volts DC / 1.5 A
Safety Standards	UL (UL60950-1) CUL (CSA C22.2 No.60950-1-03)

Wall-mounting Instructions

It is recommended that you do NOT wall-mount the STB. Wall-mounting kit is not included.

Complete the following steps to hang your STB on a wall.

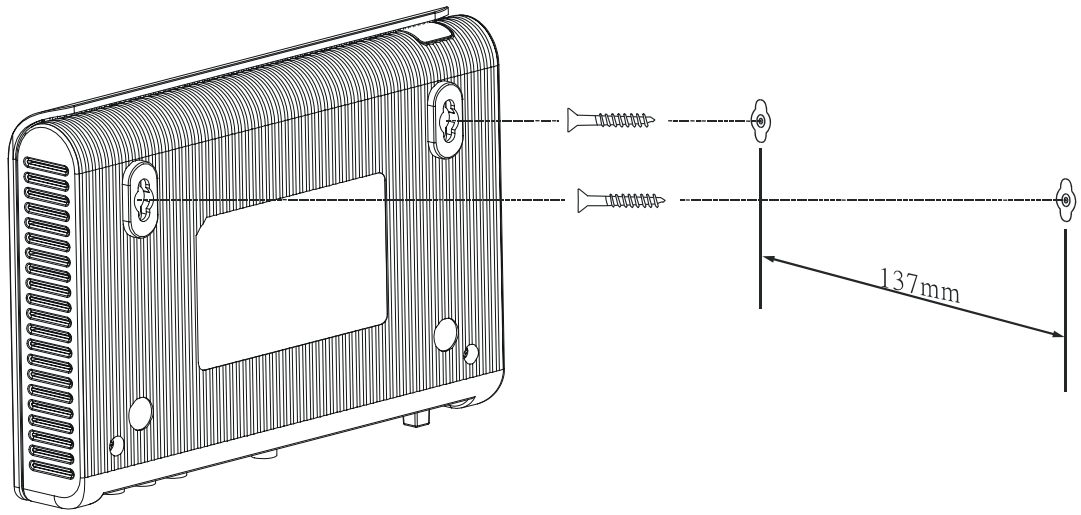
See Table 10 on page 35 for the size of screws to use and how far apart to place them.

1. Select a position free of obstructions on a sturdy wall.
2. Drill two holes for the screws.

Be careful to avoid damaging pipes or cables located inside the wall when drilling holes for the screws.

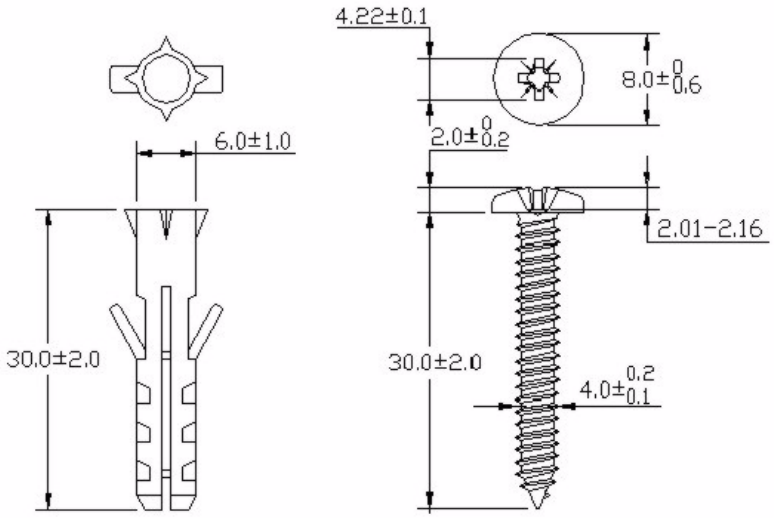
3 Do not insert the screws all the way into the wall. Leave a small gap of about 0.5 cm between the heads of the screws and the wall.
4 Make sure the screws are snugly fastened to the wall. They need to hold the weight of the STB with the connection cables.
5 Align the holes on the back of the STB with the screws on the wall. Hang the STB on the screws.

Figure 17 Wall-mounting Example



The following are dimensions of an M4 tap screw and masonry plug used for wall mounting. All measurements are in millimeters (mm).

Figure 18 Masonry Plug and M4 Tap Screw



PART II Appendices and Index

The appendices provide general information. Some details may not apply to your STB.

Setting up Your Computer's IP Address (41)

IP Addresses and Subnetting (63)

Legal Information (73)

Customer Support (77)

Index (83)

A

Setting up Your Computer's IP Address

All computers must have a 10M or 100M Ethernet adapter card and TCP/IP installed.

Windows 95/98/Me/NT/2000/XP/Vista, Macintosh OS 7 and later operating systems and all versions of UNIX/LINUX include the software components you need to install and use TCP/IP on your computer. Windows 3.1 requires the purchase of a third-party TCP/IP application package.

TCP/IP should already be installed on computers using Windows NT/2000/XP, Macintosh OS 7 and later operating systems.

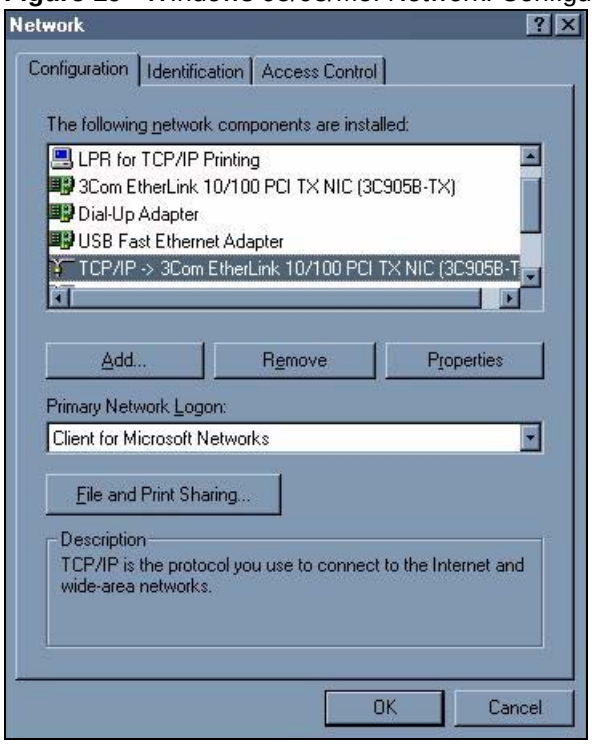
After the appropriate TCP/IP components are installed, configure the TCP/IP settings in order to "communicate" with your network.

If you manually assign IP information instead of using dynamic assignment, make sure that your computers have IP addresses that place them in the same subnet as the STB's LAN port.

Windows 95/98/Me

Click **Start**, **Settings**, **Control Panel** and double-click the **Network** icon to open the **Network** window.

Figure 19 WIndows 95/98/Me: Network: Configuration



Installing Components

The **Network** window **Configuration** tab displays a list of installed components. You need a network adapter, the TCP/IP protocol and Client for Microsoft Networks.

If you need the adapter:

1. In the **Network** window, click **Add**.
2. Select **Adapter** and then click **Add**.
3. Select the manufacturer and model of your network adapter and then click **OK**.

If you need TCP/IP:

1. In the **Network** window, click **Add**.
2. Select **Protocol** and then click **Add**.
3. Select **Microsoft** from the list of **manufacturers**.
4. Select **TCP/IP** from the list of network protocols and then click **OK**.

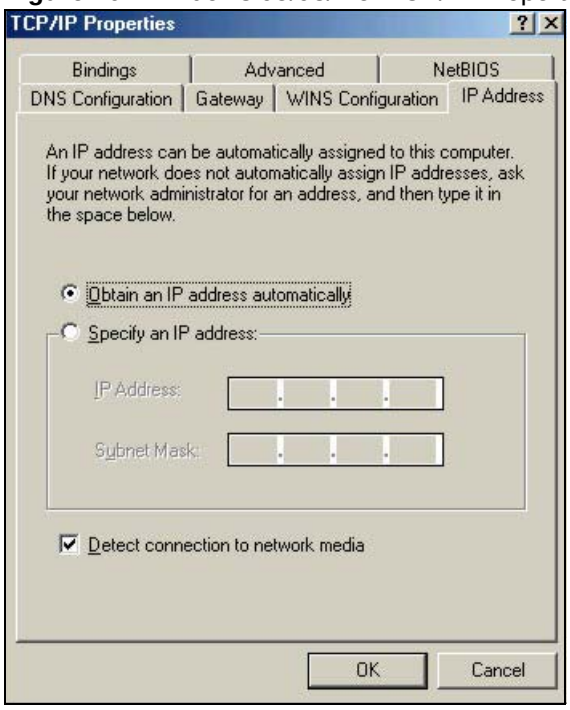
If you need Client for Microsoft Networks:

1. Click **Add**.
2. Select **Client** and then click **Add**.
3. Select **Microsoft** from the list of manufacturers.
4. Select **Client for Microsoft Networks** from the list of network clients and then click **OK**.
5. Restart your computer so the changes you made take effect.

Configuring

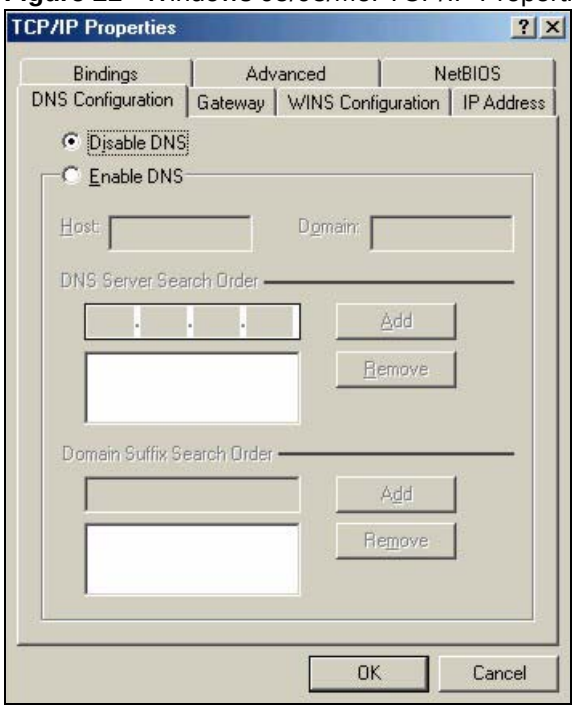
1. In the **Network** window **Configuration** tab, select your network adapter's TCP/IP entry and click **Properties**
2. Click the **IP Address** tab.
   - If your IP address is dynamic, select **Obtain an IP address automatically**.
   - If you have a static IP address, select **Specify an IP address** and type your information into the **IP Address** and **Subnet Mask** fields.

Figure 20 Windows 95/98/Me: TCP/IP Properties: IP Address


TCP/IP Properties
Bindings
Advanced
NetBIOS
DNS Configuration
Gateway
WINS Configuration
IP Address
An IP address can be automatically assigned to this computer. If your network does not automatically assign IP addresses, ask your network administrator for an address, and then type it in the space below.
Obtain an IP address automatically
Specify an IP address:
IP Address:
Subnet Mask:
Detect connection to network media
OK
Cancel

3. Click the **DNS** Configuration tab.
   - If you do not know your DNS information, select **Disable DNS**.
   - If you know your DNS information, select **Enable DNS** and type the information in the fields below (you may not need to fill them all in).

Figure 21 Windows 95/98/Me: TCP/IP Properties: DNS Configuration



4 Click the **Gateway** tab.
   - If you do not know your gateway's IP address, remove previously installed gateways.
   - If you have a gateway IP address, type it in the **New gateway field** and click **Add**.
5 Click **OK** to save and close the **TCP/IP Properties** window.
6 Click **OK** to close the **Network** window. Insert the Windows CD if prompted.
7 Turn on your STB and restart your computer when prompted.

Verifying Settings

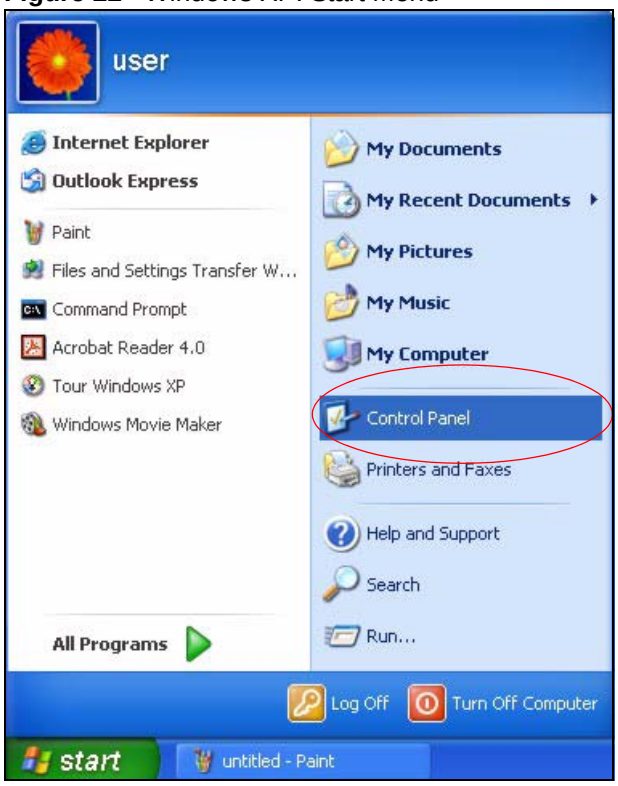
1 Click **Start** and then **Run**.
2 In the **Run** window, type "winipcfg" and then click **OK** to open the **IP Configuration** window.
3 Select your network adapter. You should see your computer's IP address, subnet mask and default gateway.

Windows 2000/NT/XP

The following example figures use the default Windows XP GUI theme.

1 Click **start** (**Start** in Windows 2000/NT), **Settings**, **Control Panel**.

Figure 22 Windows XP: Start Menu

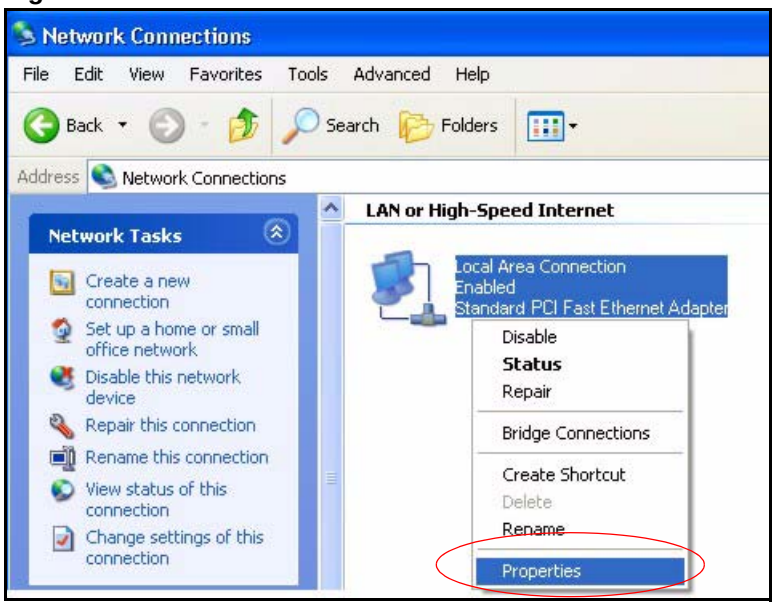


2 In the **Control Panel**, double-click **Network Connections** (**Network and Dial-up Connections** in Windows 2000/NT).

Figure 23 Windows XP: Control Panel

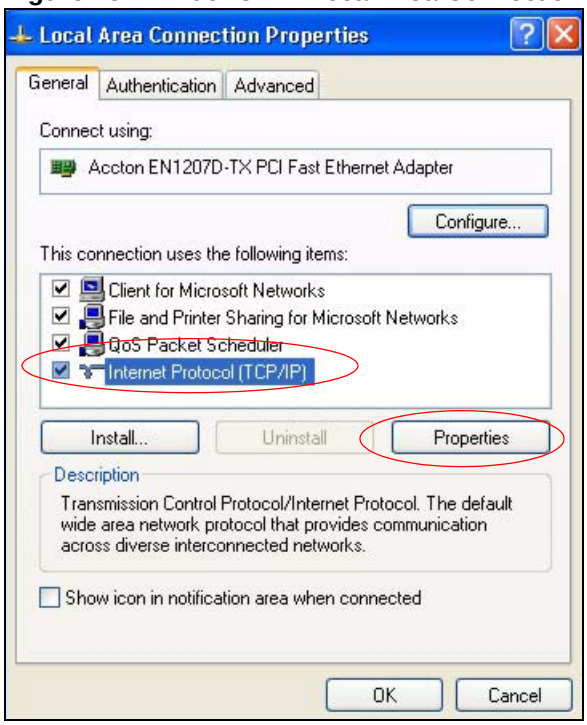
3 Right-click **Local Area Connection** and then click **Properties**.

Figure 24 Windows XP: Control Panel: Network Connections: Properties



4 Select **Internet Protocol (TCP/IP)** (under the **General** tab in Win XP) and then click **Properties**.

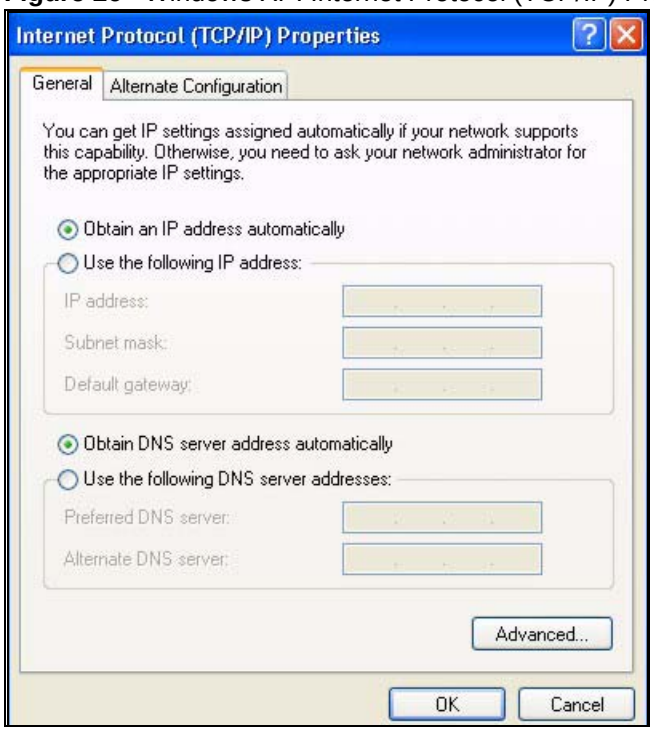
Figure 25 Windows XP: Local Area Connection Properties


Local Area Connection Properties
General Authentication Advanced
Connect using:
Accton EN1207D-TX PCI Fast Ethernet Adapter
Configure...
This connection uses the following items:
Client for Microsoft Networks
File and Printer Sharing for Microsoft Networks
QoS Packet Scheduler
Internet Protocol (TCP/IP)
Install... Uninstall Properties
Description
Transmission Control Protocol/Internet Protocol. The default wide area network protocol that provides communication across diverse interconnected networks.
Show icon in notification area when connected
OK Cancel

5 The **Internet Protocol TCP/IP Properties** window opens (the **General tab** in Windows XP).

- If you have a dynamic IP address click **Obtain an IP address automatically**.
- If you have a static IP address click **Use the following IP Address** and fill in the **IP address**, **Subnet mask**, and **Default gateway** fields.
- Click **Advanced**.

Figure 26 Windows XP: Internet Protocol (TCP/IP) Properties

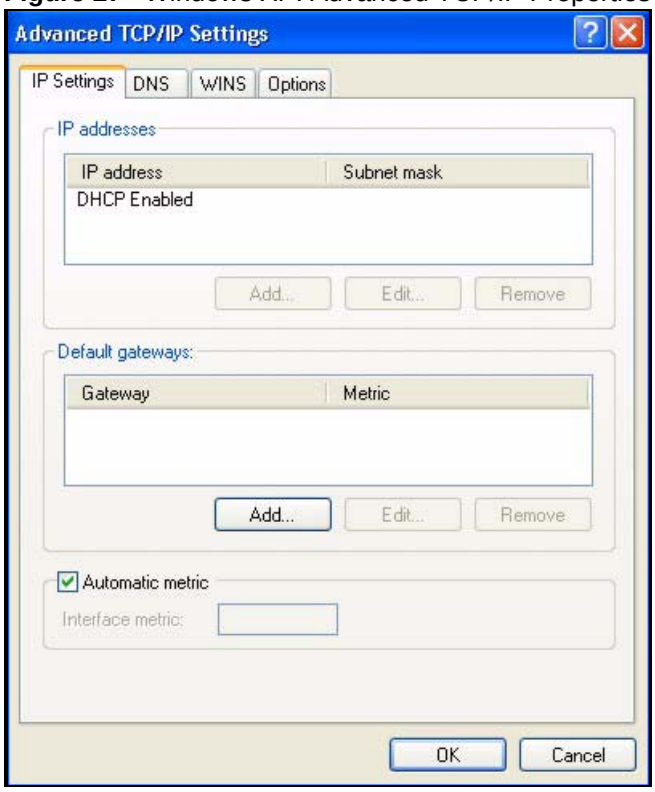

Internet Protocol (TCP/IP) Properties
General
Alternate Configuration
You can get IP settings assigned automatically if your network supports this capability. Otherwise, you need to ask your network administrator for the appropriate IP settings.
Obtain an IP address automatically
Use the following IP address:
IP address:
Subnet mask:
Default gateway:
Obtain DNS server address automatically
Use the following DNS server addresses:
Preferred DNS server:
Alternate DNS server:
Advanced...
OK
Cancel

6 If you do not know your gateway's IP address, remove any previously installed gateways in the **IP Settings** tab and click **OK**.

Do one or more of the following if you want to configure additional IP addresses:

- In the **IP Settings** tab, in IP addresses, click **Add**.
- In **TCP/IP Address**, type an IP address in **IP address** and a subnet mask in **Subnet mask**, and then click **Add**.
- Repeat the above two steps for each IP address you want to add.
- Configure additional default gateways in the **IP Settings** tab by clicking **Add** in **Default gateways**.
- In **TCP/IP Gateway Address**, type the IP address of the default gateway in **Gateway**. To manually configure a default metric (the number of transmission hops), clear the **Automatic metric** check box and type a metric in **Metric**.
- Click **Add**.
- Repeat the previous three steps for each default gateway you want to add.
- Click **OK** when finished.

Figure 27 Windows XP: Advanced TCP/IP Properties

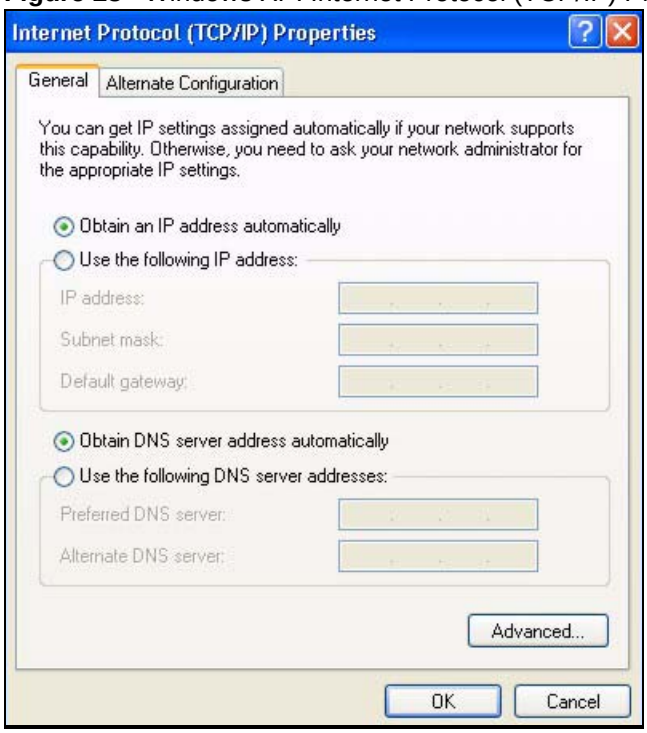


7 In the **Internet Protocol TCP/IP Properties** window (the **General** tab in Windows XP):

- Click **Obtain DNS server address automatically** if you do not know your DNS server IP address(es).
- If you know your DNS server IP address(es), click **Use the following DNS server addresses**, and type them in the **Preferred DNS server** and **Alternate DNS server** fields.

  If you have previously configured DNS servers, click **Advanced** and then the **DNS** tab to order them.

Figure 28 Windows XP: Internet Protocol (TCP/IP) Properties


Internet Protocol (TCP/IP) Properties
General
Alternate Configuration
You can get IP settings assigned automatically if your network supports this capability. Otherwise, you need to ask your network administrator for the appropriate IP settings.
Obtain an IP address automatically
Use the following IP address:
IP address:
Subnet mask:
Default gateway:
Obtain DNS server address automatically
Use the following DNS server addresses:
Preferred DNS server:
Alternate DNS server:
Advanced...
OK
Cancel

8 Click **OK** to close the **Internet Protocol (TCP/IP) Properties** window.

9 Click **Close** (**OK** in Windows 2000/NT) to close the **Local Area Connection Properties** window.

10 Close the **Network Connections** window (**Network and Dial-up Connections** in Windows 2000/NT).

11 Turn on your STB and restart your computer (if prompted).

Verifying Settings

1 Click **Start**, **All Programs**, **Accessories** and then **Command Prompt**.

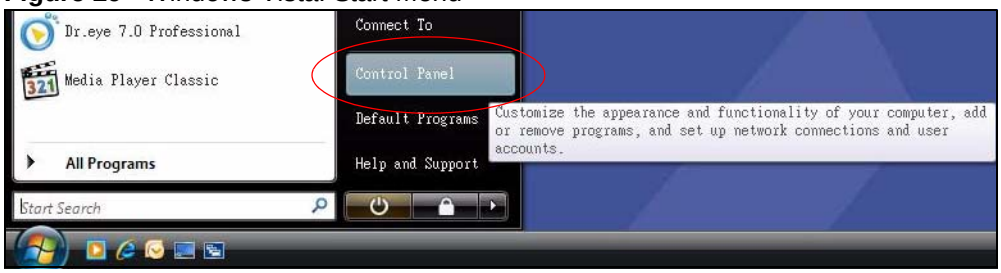
2 In the **Command Prompt** window, type "ipconfig" and then press [ENTER]. You can also open **Network Connections**, right-click a network connection, click **Status** and then click the **Support** tab.

Windows Vista

This section shows screens from Windows Vista Enterprise Version 6.0.

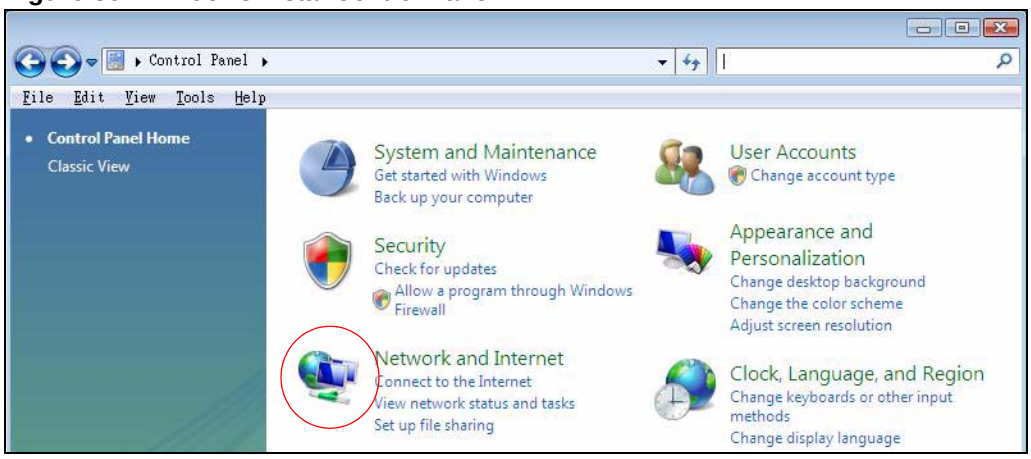
1 Click the **Start** icon, **Control Panel**.

Figure 29 Windows Vista: Start Menu


Dr.eye 7.0 Professional
Media Player Classic
All Programs
Start Search
Connect To
Control Panel
Default Programs
Help and Support
Customize the appearance and functionality of your computer, add or remove programs, and set up network connections and user accounts.

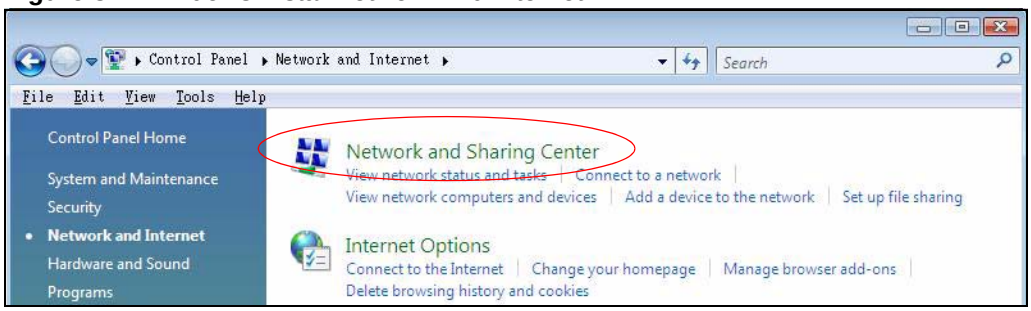
2 In the **Control Panel**, double-click **Network and Internet**.

Figure 30 Windows Vista: Control Panel



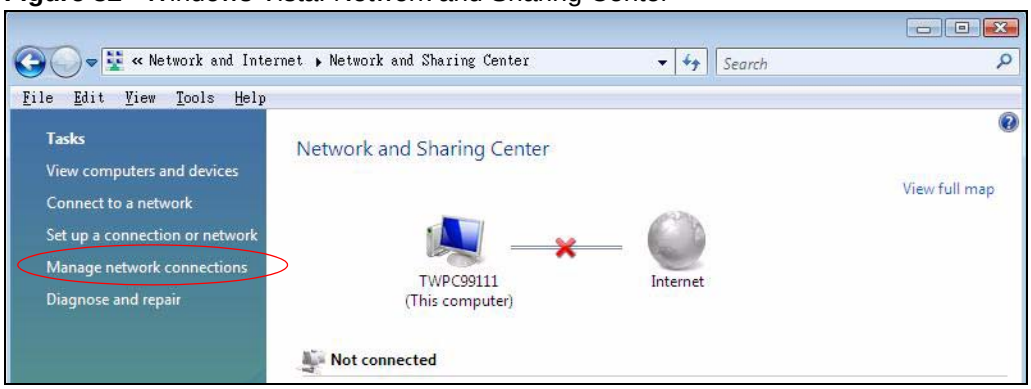
3 Click **Network and Sharing Center**.

Figure 31 Windows Vista: Network And Internet



4 Click **Manage network connections**.

Figure 32 Windows Vista: Network and Sharing Center



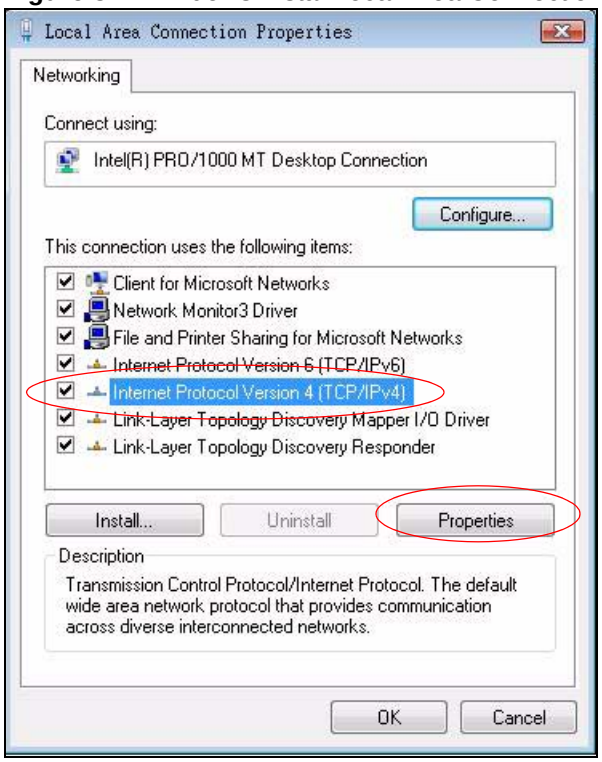
5 Right-click **Local Area Connection** and then click **Properties**.

During this procedure, click **Continue** whenever Windows displays a screen saying that it needs your permission to continue.

Figure 33 Windows Vista: Network and Sharing Center

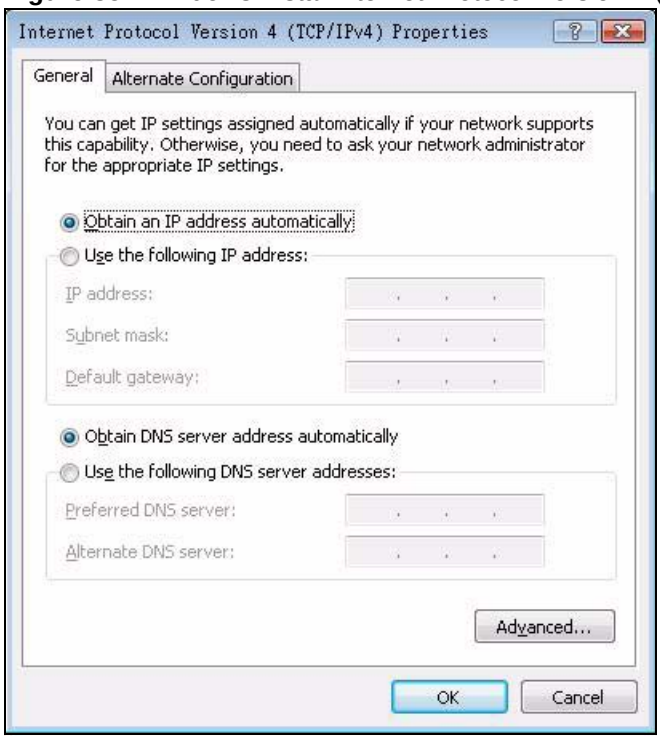
6 Select **Internet Protocol Version 4 (TCP/IPv4)** and click **Properties**.

Figure 34 Windows Vista: Local Area Connection Properties



7 The **Internet Protocol Version 4 (TCP/IPv4) Properties** window opens (the **General tab**).
- If you have a dynamic IP address click **Obtain an IP address automatically**.
- If you have a static IP address click **Use the following IP address** and fill in the **IP address**, **Subnet mask**, and **Default gateway** fields.
- Click **Advanced**.

Figure 35 Windows Vista: Internet Protocol Version 4 (TCP/IPv4) Properties

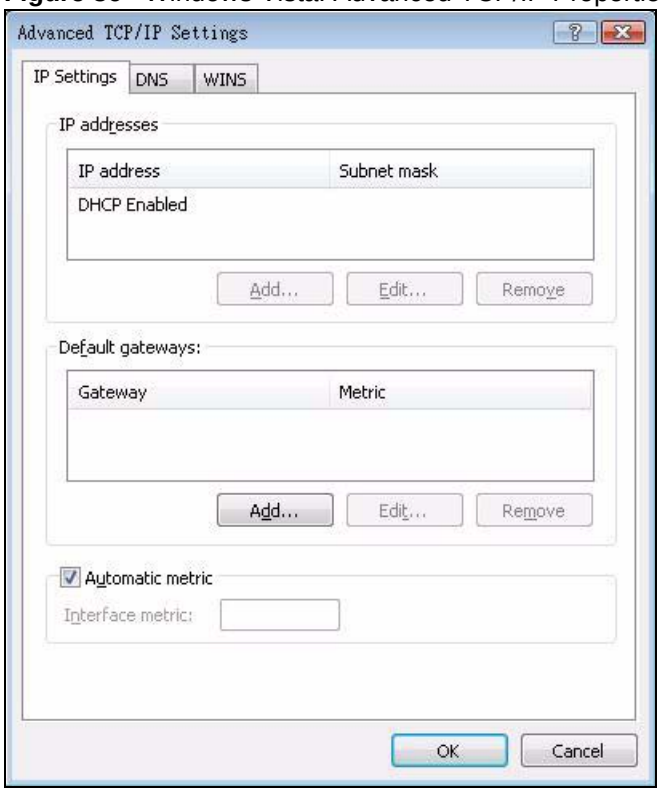

Internet Protocol Version 4 (TCP/IPv4) Properties
General
Alternate Configuration
You can get IP settings assigned automatically if your network supports this capability. Otherwise, you need to ask your network administrator for the appropriate IP settings.
Obtain an IP address automatically
Use the following IP address:
IP address:
Subnet mask:
Default gateway:
Obtain DNS server address automatically
Use the following DNS server addresses:
Preferred DNS server:
Alternate DNS server:
Advanced...
OK
Cancel

8 If you do not know your gateway's IP address, remove any previously installed gateways in the **IP Settings** tab and click **OK**.

Do one or more of the following if you want to configure additional IP addresses:

- In the **IP Settings** tab, in IP addresses, click **Add**.
- In **TCP/IP Address**, type an IP address in **IP address** and a subnet mask in **Subnet mask**, and then click **Add**.
- Repeat the above two steps for each IP address you want to add.
- Configure additional default gateways in the **IP Settings** tab by clicking **Add** in **Default gateways**.
- In **TCP/IP Gateway Address**, type the IP address of the default gateway in **Gateway**. To manually configure a default metric (the number of transmission hops), clear the **Automatic metric** check box and type a metric in **Metric**.
- Click **Add**.
- Repeat the previous three steps for each default gateway you want to add.
- Click **OK** when finished.

Figure 36 Windows Vista: Advanced TCP/IP Properties

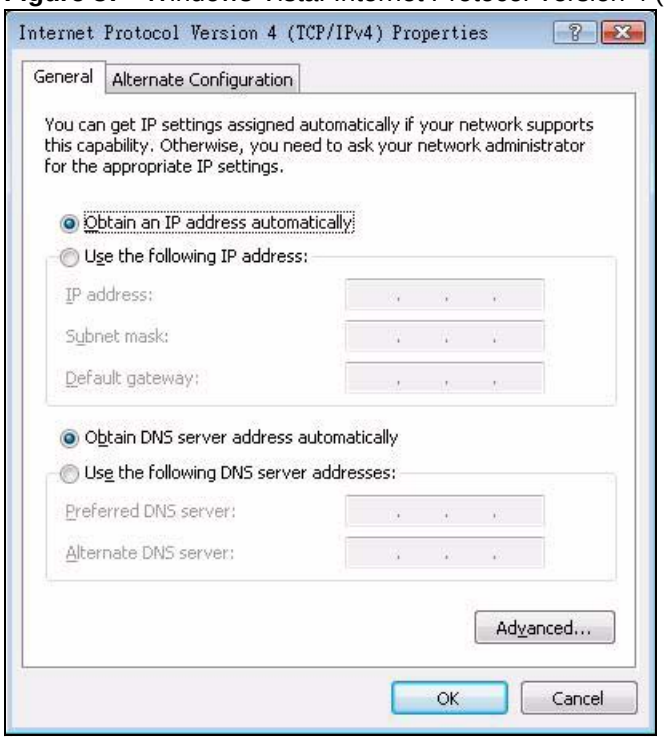


9 In the **Internet Protocol Version 4 (TCP/IPv4) Properties** window, (the **General tab**):

- Click **Obtain DNS server address automatically** if you do not know your DNS server IP address(es).
- If you know your DNS server IP address(es), click **Use the following DNS server addresses**, and type them in the **Preferred DNS server** and **Alternate DNS server** fields.

  If you have previously configured DNS servers, click **Advanced** and then the **DNS** tab to order them.

Figure 37 Windows Vista: Internet Protocol Version 4 (TCP/IPv4) Properties


Internet Protocol Version 4 (TCP/IPv4) Properties
General
Alternate Configuration
You can get IP settings assigned automatically if your network supports this capability. Otherwise, you need to ask your network administrator for the appropriate IP settings.
Obtain an IP address automatically
Use the following IP address:
IP address:
Subnet mask:
Default gateway:
Obtain DNS server address automatically
Use the following DNS server addresses:
Preferred DNS server:
Alternate DNS server:
Advanced...
OK
Cancel

10 Click **OK** to close the **Internet Protocol Version 4 (TCP/IPv4) Properties** window.

11 Click **Close** to close the **Local Area Connection Properties** window.

12 Close the **Network Connections** window.

13 Turn on your STB and restart your computer (if prompted).

Verifying Settings

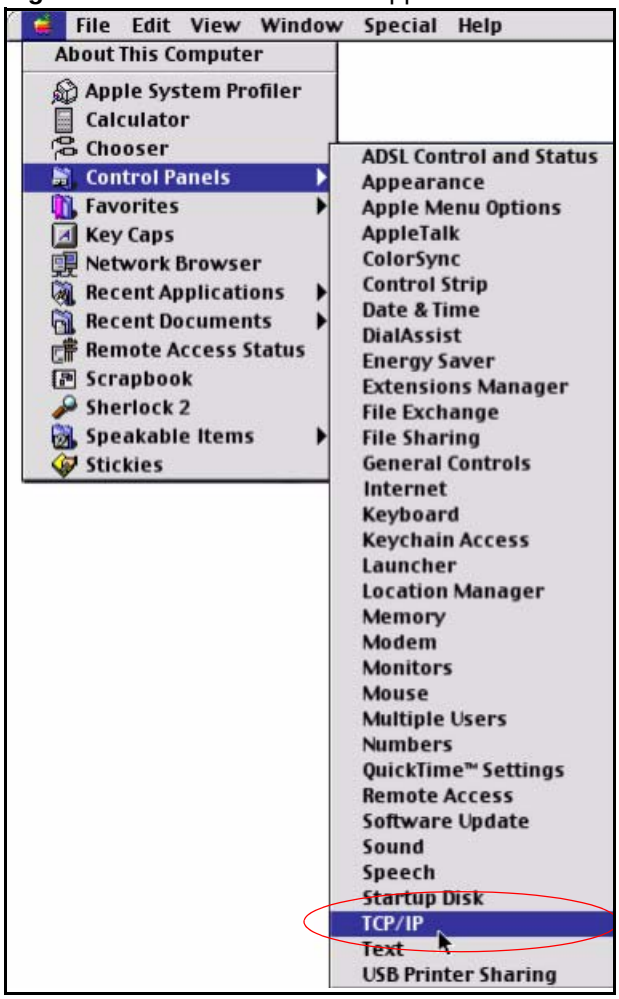
1 Click **Start**, **All Programs**, **Accessories** and then **Command Prompt**.

2 In the **Command Prompt** window, type "ipconfig" and then press [ENTER]. You can also open **Network Connections**, right-click a network connection, click **Status** and then click the **Support** tab.

Macintosh OS 8/9

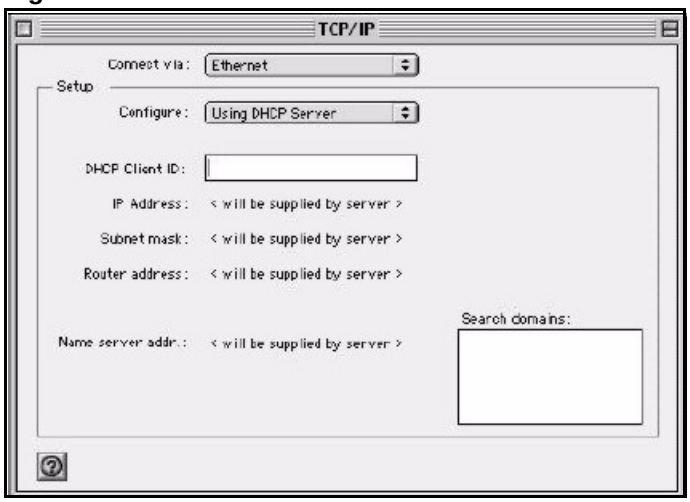
1 Click the **Apple** menu, **Control Panel** and double-click **TCP/IP** to open the **TCP/IP Control Panel**.

Figure 38 Macintosh OS 8/9: Apple Menu



2 Select **Ethernet built-in** from the **Connect via** list.

Figure 39 Macintosh OS 8/9: TCP/IP



3 For dynamically assigned settings, select **Using DHCP Server** from the **Configure:** list.

4 For statically assigned settings, do the following:

- From the **Configure** box, select **Manually**.

- Type your IP address in the **IP Address** box.
- Type your subnet mask in the **Subnet mask** box.
- Type the IP address of your STB in the **Router address** box.

5 Close the **TCP/IP Control Panel**.

6 Click **Save** if prompted, to save changes to your configuration.

7 Turn on your STB and restart your computer (if prompted).

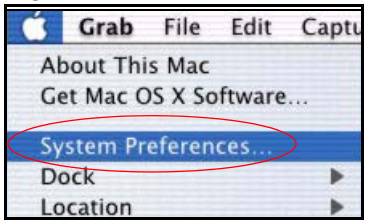
Verifying Settings

Check your TCP/IP properties in the **TCP/IP Control Panel** window.

Macintosh OS X

1 Click the **Apple** menu, and click **System Preferences** to open the **System Preferences** window.

Figure 40 Macintosh OS X: Apple Menu

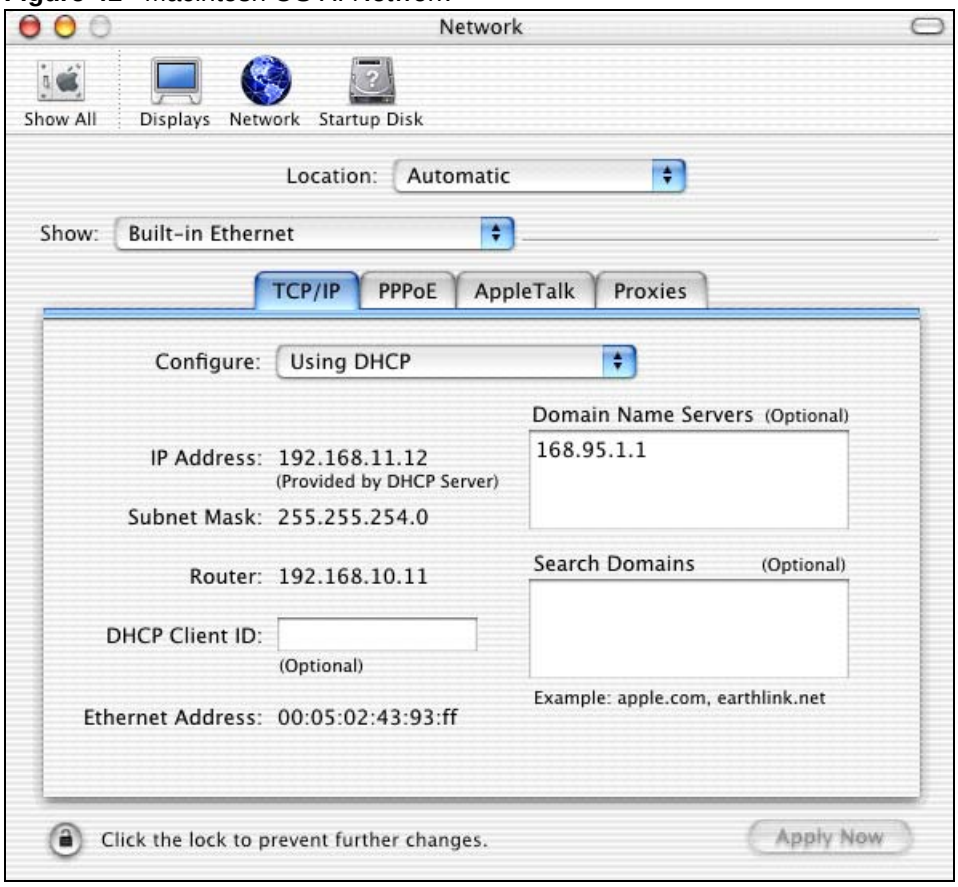


2 Click **Network** in the icon bar.

- Select **Automatic** from the **Location** list.
- Select **Built-in Ethernet** from the **Show** list.
- Click the **TCP/IP** tab.

3 For dynamically assigned settings, select **Using DHCP** from the **Configure** list.

Figure 41 Macintosh OS X: Network



4. For statically assigned settings, do the following:
   - From the **Configure** box, select **Manually**.
   - Type your IP address in the **IP Address** box.
   - Type your subnet mask in the **Subnet mask** box.
   - Type the IP address of your STB in the **Router address** box.
5. Click **Apply Now** and close the window.
6. Turn on your STB and restart your computer (if prompted).

Verifying Settings

Check your TCP/IP properties in the **Network** window.

Linux

This section shows you how to configure your computer's TCP/IP settings in Red Hat Linux 9.0. Procedure, screens and file location may vary depending on your Linux distribution and release version.

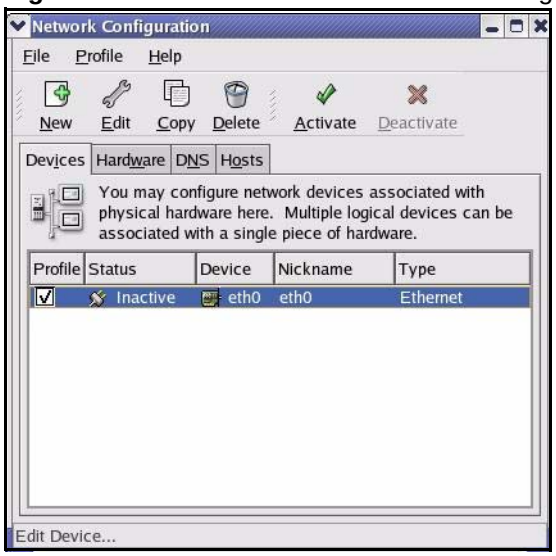
Make sure you are logged in as the root administrator.

Using the K Desktop Environment (KDE)

Follow the steps below to configure your computer IP address using the KDE.

1 Click the Red Hat button (located on the bottom left corner), select **System Setting** and click **Network**.

Figure 42 Red Hat 9.0: KDE: Network Configuration: Devices



2 Double-click on the profile of the network card you wish to configure. The **Ethernet Device General** screen displays as shown.

Figure 43 Red Hat 9.0: KDE: Ethernet Device: General

- If you have a dynamic IP address, click **Automatically obtain IP address settings with** and select **dhcp** from the drop down list.
- If you have a static IP address, click **Statically set IP Addresses** and fill in the **Address**, **Subnet mask**, and **Default Gateway Address** fields.

3 Click **OK** to save the changes and close the **Ethernet Device General** screen.

4 If you know your DNS server IP address(es), click the **DNS** tab in the **Network Configuration** screen. Enter the DNS server information in the fields provided.

Figure 44 Red Hat 9.0: KDE: Network Configuration: DNS

5 Click the **Devices** tab.

6 Click the **Activate** button to apply the changes. The following screen displays. Click **Yes to save the changes in all screens.**

Figure 45 Red Hat 9.0: KDE: Network Configuration: Activate

Question
redhat-config-network:
You have made some changes in your configuration.
To activate the network device eth0, the changes have to be saved.
Do you want to continue?
No
Yes

7 After the network card restart process is complete, make sure the **Status** is **Active** in the **Network Configuration** screen.

Using Configuration Files

Follow the steps below to edit the network configuration files and set your computer IP address.

1 Assuming that you have only one network card on the computer, locate the `ifconfig-eth0` configuration file (where `eth0` is the name of the Ethernet card). Open the configuration file with any plain text editor.

- If you have a dynamic IP address, enter **`dhcp`** in the `BOOTPROTO=` field. The following figure shows an example.

Figure 46 Red Hat 9.0: Dynamic IP Address Setting in ifconfig-eth0

```
DEVICE=eth0
ONBOOT=yes
BOOTPROTO=dhcp
USERCTL=no
PEERDNS=yes
TYPE=Ethernet
```

- If you have a static IP address, enter **static** in the BOOTPROTO= field. Type IPADDR= followed by the IP address (in dotted decimal notation) and type NETMASK= followed by the subnet mask. The following example shows an example where the static IP address is 192.168.1.10 and the subnet mask is 255.255.255.0.

Figure 47 Red Hat 9.0: Static IP Address Setting in ifconfig-eth0

```
DEVICE=eth0
ONBOOT=yes
BOOTPROTO=static
IPADDR=192.168.1.10
NETMASK=255.255.255.0
USERCTL=no
PEERDNS=yes
TYPE=Ethernet
```

2 If you know your DNS server IP address(es), enter the DNS server information in the `resolv.conf` file in the `/etc` directory. The following figure shows an example where two DNS server IP addresses are specified.

Figure 48 Red Hat 9.0: DNS Settings in resolv.conf

```
nameserver 172.23.5.1
nameserver 172.23.5.2
```

3 After you edit and save the configuration files, you must restart the network card. Enter `./network restart` in the `/etc/rc.d/init.d` directory. The following figure shows an example.

Figure 49 Red Hat 9.0: Restart Ethernet Card

```
[root@localhost init.d]# network restart

Shutting down interface eth0:                [OK]
Shutting down loopback interface:            [OK]
Setting network parameters:                  [OK]
Bringing up loopback interface:              [OK]
Bringing up interface eth0:                  [OK]
```

Verifying Settings

Enter `ifconfig` in a terminal screen to check your TCP/IP properties.

Figure 50 Red Hat 9.0: Checking TCP/IP Properties

```
[root@localhost]# ifconfig
eth0      Link encap:Ethernet  HWaddr 00:50:BA:72:5B:44
          inet addr:172.23.19.129  Bcast:172.23.19.255  Mask:255.255.255.0
          UP BROADCAST RUNNING MULTICAST  MTU:1500  Metric:1
          RX packets:717 errors:0 dropped:0 overruns:0 frame:0
          TX packets:13 errors:0 dropped:0 overruns:0 carrier:0
          collisions:0 txqueuelen:100
          RX bytes:730412 (713.2 Kb)  TX bytes:1570 (1.5 Kb)
          Interrupt:10 Base address:0x1000
[root@localhost]#
```

B

IP Addresses and Subnetting

This appendix introduces IP addresses and subnet masks.

IP addresses identify individual devices on a network. Every networking device (including computers, servers, routers, printers, etc.) needs an IP address to communicate across the network. These networking devices are also known as hosts.

Subnet masks determine the maximum number of possible hosts on a network. You can also use subnet masks to divide one network into multiple sub-networks.

Introduction to IP Addresses

One part of the IP address is the network number, and the other part is the host ID. In the same way that houses on a street share a common street name, the hosts on a network share a common network number. Similarly, as each house has its own house number, each host on the network has its own unique identifying number - the host ID. Routers use the network number to send packets to the correct network, while the host ID determines to which host on the network the packets are delivered.

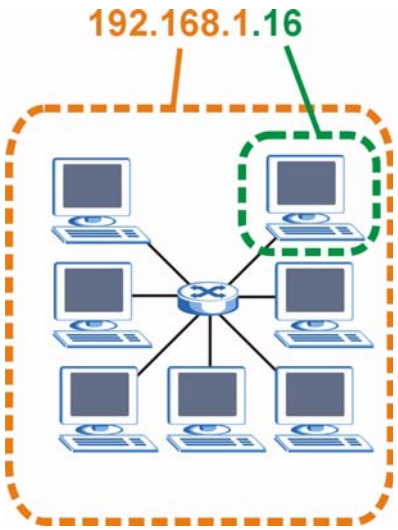
Structure

An IP address is made up of four parts, written in dotted decimal notation (for example, 192.168.1.1). Each of these four parts is known as an octet. An octet is an eight-digit binary number (for example 11000000, which is 192 in decimal notation).

Therefore, each octet has a possible range of 00000000 to 11111111 in binary, or 0 to 255 in decimal.

The following figure shows an example IP address in which the first three octets (192.168.1) are the network number, and the fourth octet (16) is the host ID.

Figure 51 Network Number and Host ID



How much of the IP address is the network number and how much is the host ID varies according to the subnet mask.

Subnet Masks

A subnet mask is used to determine which bits are part of the network number, and which bits are part of the host ID (using a logical AND operation). The term "subnet" is short for "sub-network".

A subnet mask has 32 bits. If a bit in the subnet mask is a "1" then the corresponding bit in the IP address is part of the network number. If a bit in the subnet mask is "0" then the corresponding bit in the IP address is part of the host ID.

The following example shows a subnet mask identifying the network number (in bold text) and host ID of an IP address (192.168.1.2 in decimal).

Table 14 IP Address Network Number and Host ID Example

	1ST OCTET: (192)	2ND OCTET: (168)	3RD OCTET: (1)	4TH OCTET (2)
IP Address (Binary)	11000000	10101000	00000001	00000010
Subnet Mask (Binary)	**11111111**	**11111111**	**11111111**	00000000
Network Number	**11000000**	**10101000**	**00000001**	
Host ID				00000010

By convention, subnet masks always consist of a continuous sequence of ones beginning from the leftmost bit of the mask, followed by a continuous sequence of zeros, for a total number of 32 bits.

Subnet masks can be referred to by the size of the network number part (the bits with a "1" value). For example, an "8-bit mask" means that the first 8 bits of the mask are ones and the remaining 24 bits are zeroes.

Subnet masks are expressed in dotted decimal notation just like IP addresses. The following examples show the binary and decimal notation for 8-bit, 16-bit, 24-bit and 29-bit subnet masks.

Table 15 Subnet Masks

	BINARY				DECIMAL
	1ST OCTET	2ND OCTET	3RD OCTET	4TH OCTET	
8-bit mask	11111111	00000000	00000000	00000000	255.0.0.0
16-bit mask	11111111	11111111	00000000	00000000	255.255.0.0
24-bit mask	11111111	11111111	11111111	00000000	255.255.255.0
29-bit mask	11111111	11111111	11111111	11111000	255.255.255.248

Network Size

The size of the network number determines the maximum number of possible hosts you can have on your network. The larger the number of network number bits, the smaller the number of remaining host ID bits.

An IP address with host IDs of all zeros is the IP address of the network (192.168.1.0 with a 24-bit subnet mask, for example). An IP address with host IDs of all ones is the broadcast address for that network (192.168.1.255 with a 24-bit subnet mask, for example).

As these two IP addresses cannot be used for individual hosts, calculate the maximum number of possible hosts in a network as follows:

Table 16 Maximum Host Numbers

SUBNET MASK		HOST ID SIZE		MAXIMUM NUMBER OF HOSTS
8 bits	255.0.0.0	24 bits	$2^{24} - 2$	16777214
16 bits	255.255.0.0	16 bits	$2^{16} - 2$	65534
24 bits	255.255.255.0	8 bits	$2^{8} - 2$	254
29 bits	255.255.255.248	3 bits	$2^{3} - 2$	6

Notation

Since the mask is always a continuous number of ones beginning from the left, followed by a continuous number of zeros for the remainder of the 32 bit mask, you can simply specify the number of ones instead of writing the value of each octet. This is usually specified by writing a "/" followed by the number of bits in the mask after the address.

For example, 192.1.1.0 /25 is equivalent to saying 192.1.1.0 with subnet mask 255.255.255.128.

The following table shows some possible subnet masks using both notations.

Table 17 Alternative Subnet Mask Notation

SUBNET MASK	ALTERNATIVE NOTATION	LAST OCTET (BINARY)	LAST OCTET (DECIMAL)
255.255.255.0	/24	0000 0000	0
255.255.255.128	/25	1000 0000	128

Table 17 Alternative Subnet Mask Notation (continued)

SUBNET MASK	ALTERNATIVE NOTATION	LAST OCTET (BINARY)	LAST OCTET (DECIMAL)
255.255.255.192	/26	1100 0000	192
255.255.255.224	/27	1110 0000	224
255.255.255.240	/28	1111 0000	240
255.255.255.248	/29	1111 1000	248
255.255.255.252	/30	1111 1100	252

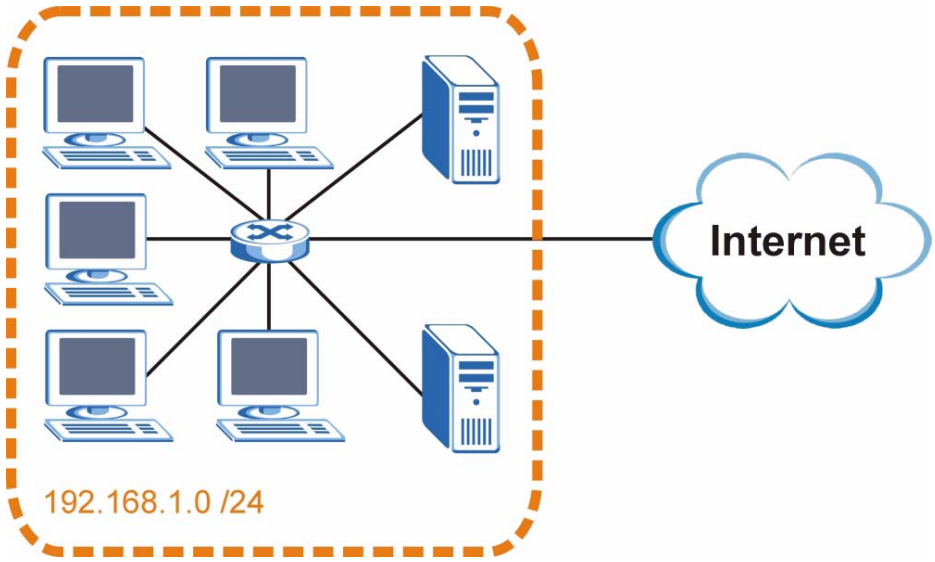
Subnetting

You can use subnetting to divide one network into multiple sub-networks. In the following example a network administrator creates two sub-networks to isolate a group of servers from the rest of the company network for security reasons.

In this example, the company network address is 192.168.1.0. The first three octets of the address (192.168.1) are the network number, and the remaining octet is the host ID, allowing a maximum of $2^8 - 2$ or 254 possible hosts.

The following figure shows the company network before subnetting.

Figure 52 Subnetting Example: Before Subnetting

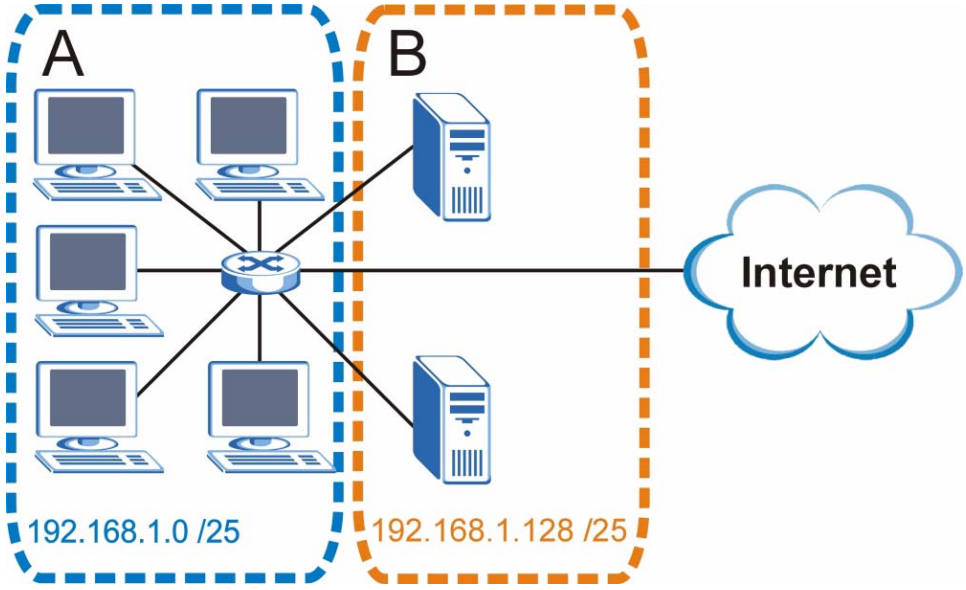


You can “borrow” one of the host ID bits to divide the network 192.168.1.0 into two separate sub-networks. The subnet mask is now 25 bits (255.255.255.128 or /25).

The “borrowed” host ID bit can have a value of either 0 or 1, allowing two subnets; 192.168.1.0 /25 and 192.168.1.128 /25.

The following figure shows the company network after subnetting. There are now two sub-networks, **A** and **B**.

Figure 53 Subnetting Example: After Subnetting



In a 25-bit subnet the host ID has 7 bits, so each sub-network has a maximum of $2^7 - 2$ or 126 possible hosts (a host ID of all zeroes is the subnet's address itself, all ones is the subnet's broadcast address).

192.168.1.0 with mask 255.255.255.128 is subnet **A** itself, and 192.168.1.127 with mask 255.255.255.128 is its broadcast address. Therefore, the lowest IP address that can be assigned to an actual host for subnet **A** is 192.168.1.1 and the highest is 192.168.1.126.

Similarly, the host ID range for subnet **B** is 192.168.1.129 to 192.168.1.254.

Example: Four Subnets

The previous example illustrated using a 25-bit subnet mask to divide a 24-bit address into two subnets. Similarly, to divide a 24-bit address into four subnets, you need to "borrow" two host ID bits to give four possible combinations (00, 01, 10 and 11). The subnet mask is 26 bits (11111111.11111111.11111111.**11**000000) or 255.255.255.192.

Each subnet contains 6 host ID bits, giving 2^6 - 2 or 62 hosts for each subnet (a host ID of all zeroes is the subnet itself, all ones is the subnet's broadcast address).

Table 18 Subnet 1

IP/SUBNET MASK	NETWORK NUMBER	LAST OCTET BIT VALUE
IP Address (Decimal)	192.168.1.	0
IP Address (Binary)	11000000.10101000.00000001.	**00**000000
Subnet Mask (Binary)	11111111.11111111.11111111.	**11**000000
Subnet Address: 192.168.1.0	Lowest Host ID: 192.168.1.1	
Broadcast Address: 192.168.1.63	Highest Host ID: 192.168.1.62	

Table 19 Subnet 2

IP/SUBNET MASK	NETWORK NUMBER	LAST OCTET BIT VALUE
IP Address	192.168.1.	64
IP Address (Binary)	11000000.10101000.00000001.	**01**000000
Subnet Mask (Binary)	11111111.11111111.11111111.	**11**000000
Subnet Address: 192.168.1.64	Lowest Host ID: 192.168.1.65	
Broadcast Address: 192.168.1.127	Highest Host ID: 192.168.1.126	

Table 20 Subnet 3

IP/SUBNET MASK	NETWORK NUMBER	LAST OCTET BIT VALUE
IP Address	192.168.1.	128
IP Address (Binary)	11000000.10101000.00000001.	**10**000000
Subnet Mask (Binary)	11111111.11111111.11111111.	**11**000000
Subnet Address: 192.168.1.128	Lowest Host ID: 192.168.1.129	
Broadcast Address: 192.168.1.191	Highest Host ID: 192.168.1.190	

Table 21 Subnet 4

IP/SUBNET MASK	NETWORK NUMBER	LAST OCTET BIT VALUE
IP Address	192.168.1.	192
IP Address (Binary)	11000000.10101000.00000001.	**11**000000
Subnet Mask (Binary)	11111111.11111111.11111111.	**11**000000
Subnet Address: 192.168.1.192	Lowest Host ID: 192.168.1.193	
Broadcast Address: 192.168.1.255	Highest Host ID: 192.168.1.254	

Example: Eight Subnets

Similarly, use a 27-bit mask to create eight subnets (000, 001, 010, 011, 100, 101, 110 and 111).

The following table shows IP address last octet values for each subnet.

Table 22 Eight Subnets

SUBNET	SUBNET ADDRESS	FIRST ADDRESS	LAST ADDRESS	BROADCAST ADDRESS
1	0	1	30	31
2	32	33	62	63
3	64	65	94	95
4	96	97	126	127

Table 22 Eight Subnets (continued)

SUBNET	SUBNET ADDRESS	FIRST ADDRESS	LAST ADDRESS	BROADCAST ADDRESS
5	128	129	158	159
6	160	161	190	191
7	192	193	222	223
8	224	225	254	255

Subnet Planning

The following table is a summary for subnet planning on a network with a 24-bit network number.

Table 23 24-bit Network Number Subnet Planning

NO. "BORROWED" HOST BITS	SUBNET MASK	NO. SUBNETS	NO. HOSTS PER SUBNET
1	255.255.255.128 (/25)	2	126
2	255.255.255.192 (/26)	4	62
3	255.255.255.224 (/27)	8	30
4	255.255.255.240 (/28)	16	14
5	255.255.255.248 (/29)	32	6
6	255.255.255.252 (/30)	64	2
7	255.255.255.254 (/31)	128	1

The following table is a summary for subnet planning on a network with a 16-bit network number.

Table 24 16-bit Network Number Subnet Planning

NO. "BORROWED" HOST BITS	SUBNET MASK	NO. SUBNETS	NO. HOSTS PER SUBNET
1	255.255.128.0 (/17)	2	32766
2	255.255.192.0 (/18)	4	16382
3	255.255.224.0 (/19)	8	8190
4	255.255.240.0 (/20)	16	4094
5	255.255.248.0 (/21)	32	2046
6	255.255.252.0 (/22)	64	1022
7	255.255.254.0 (/23)	128	510
8	255.255.255.0 (/24)	256	254
9	255.255.255.128 (/25)	512	126
10	255.255.255.192 (/26)	1024	62
11	255.255.255.224 (/27)	2048	30
12	255.255.255.240 (/28)	4096	14
13	255.255.255.248 (/29)	8192	6

Table 24 16-bit Network Number Subnet Planning (continued)

NO. "BORROWED" HOST BITS	SUBNET MASK	NO. SUBNETS	NO. HOSTS PER SUBNET
14	255.255.255.252 (/30)	16384	2
15	255.255.255.254 (/31)	32768	1

Configuring IP Addresses

Where you obtain your network number depends on your particular situation. If the ISP or your network administrator assigns you a block of registered IP addresses, follow their instructions in selecting the IP addresses and the subnet mask.

If the ISP did not explicitly give you an IP network number, then most likely you have a single user account and the ISP will assign you a dynamic IP address when the connection is established. If this is the case, it is recommended that you select a network number from 192.168.0.0 to 192.168.255.0. The Internet Assigned Number Authority (IANA) reserved this block of addresses specifically for private use; please do not use any other number unless you are told otherwise. You must also enable Network Address Translation (NAT) on the STB.

Once you have decided on the network number, pick an IP address for your STB that is easy to remember (for instance, 192.168.1.1) but make sure that no other device on your network is using that IP address.

The subnet mask specifies the network number portion of an IP address. Your STB will compute the subnet mask automatically based on the IP address that you entered. You don't need to change the subnet mask computed by the STB unless you are instructed to do otherwise.

Private IP Addresses

Every machine on the Internet must have a unique address. If your networks are isolated from the Internet (running only between two branch offices, for example) you can assign any IP addresses to the hosts without problems. However, the Internet Assigned Numbers Authority (IANA) has reserved the following three blocks of IP addresses specifically for private networks:

- 10.0.0.0 — 10.255.255.255
- 172.16.0.0 — 172.31.255.255
- 192.168.0.0 — 192.168.255.255

You can obtain your IP address from the IANA, from an ISP, or it can be assigned from a private network. If you belong to a small organization and your Internet access is through an ISP, the ISP can provide you with the Internet addresses for your local networks. On the other hand, if you are part of a much larger organization, you should consult your network administrator for the appropriate IP addresses.

Regardless of your particular situation, do not create an arbitrary IP address; always follow the guidelines above. For more information on address assignment, please refer to RFC 1597, Address Allocation for Private Internets and RFC 1466, Guidelines for Management of IP Address Space.

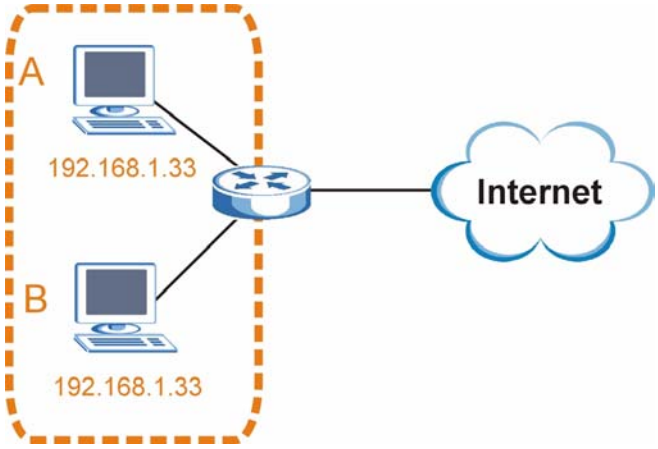
IP Address Conflicts

Each device on a network must have a unique IP address. Devices with duplicate IP addresses on the same network will not be able to access the Internet or other resources. The devices may also be unreachable through the network.

Conflicting Computer IP Addresses Example

More than one device can not use the same IP address. In the following example computer **A** has a static (or fixed) IP address that is the same as the IP address that a DHCP server assigns to computer **B** which is a DHCP client. Neither can access the Internet. This problem can be solved by assigning a different static IP address to computer **A** or setting computer **A** to obtain an IP address automatically.

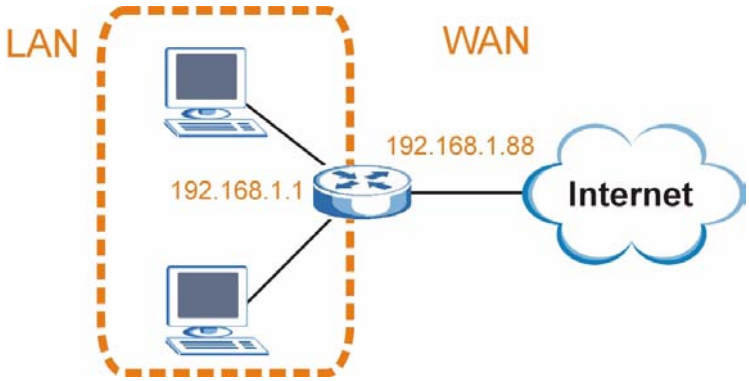
Figure 54 Conflicting Computer IP Addresses Example



Conflicting Router IP Addresses Example

Since a router connects different networks, it must have interfaces using different network numbers. For example, if a router is set between a LAN and the Internet (WAN), the router's LAN and WAN addresses must be on different subnets. In the following example, the LAN and WAN are on the same subnet. The LAN computers cannot access the Internet because the router cannot route between networks.

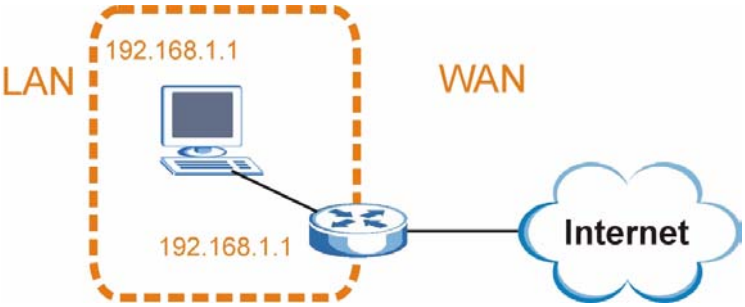
Figure 55 Conflicting Computer IP Addresses Example



Conflicting Computer and Router IP Addresses Example

More than one device can not use the same IP address. In the following example, the computer and the router's LAN port both use 192.168.1.1 as the IP address. The computer cannot access the Internet. This problem can be solved by assigning a different IP address to the computer or the router's LAN port.

Figure 56 Conflicting Computer and Router IP Addresses Example



C

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Federal Communications Commission (FCC) Interference Statement

The device complies with Part 15 of FCC rules. Operation is subject to the following two conditions:

- This device may not cause harmful interference.
- This device must accept any interference received, including interference that may cause undesired operations.

This device has been tested and found to comply with the limits for a Class B digital device pursuant to Part 15 of the FCC Rules. These limits are designed to provide reasonable protection against harmful interference in a residential installation. This device generates, uses, and can radiate radio frequency energy, and if not installed and used in accordance with the instructions, may cause harmful interference to radio communications. However, there is no guarantee that interference will not occur in a particular installation.

If this device does cause harmful interference to radio/television reception, which can be determined by turning the device off and on, the user is encouraged to try to correct the interference by one or more of the following measures:

1. Reorient or relocate the receiving antenna.
2. Increase the separation between the equipment and the receiver.
3. Connect the equipment into an outlet on a circuit different from that to which the receiver is connected.
4. Consult the dealer or an experienced radio/TV technician for help.

Notices

Changes or modifications not expressly approved by the party responsible for compliance could void the user's authority to operate the equipment.

This Class B digital apparatus complies with Canadian ICES-003.

Cet appareil numérique de la classe B est conforme à la norme NMB-003 du Canada.

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1. Go to http://www.zyxel.com.
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Registration

Register your product online to receive e-mail notices of firmware upgrades and information at www.zyxel.com for global products, or at www.us.zyxel.com for North American products.

D

Customer Support

In the event of problems that cannot be solved by using this manual, you should contact your vendor. If you cannot contact your vendor, then contact a ZyXEL office for the region in which you bought the device. Regional offices are listed below (see also http://www.zyxel.com/web/contact_us.php). Please have the following information ready when you contact an office.

Required Information

- Product model and serial number.
- Warranty Information.
- Date that you received your device.
- Brief description of the problem and the steps you took to solve it.

"+" is the (prefix) number you dial to make an international telephone call.

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